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Electrical World

F. M. FEIKER, *Editorial Director* W. H. ONKEN, JR., *Editor*

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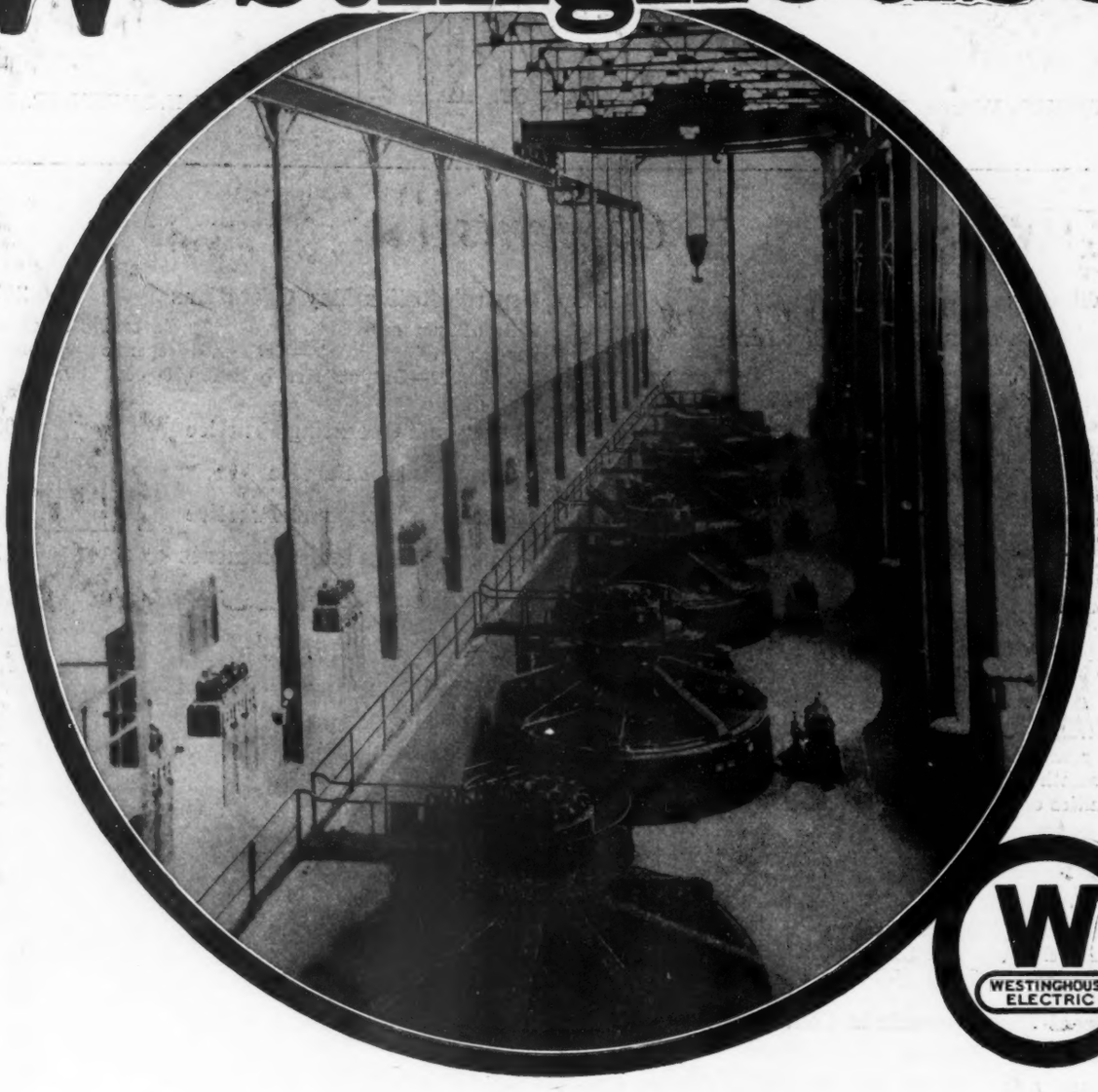

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Electrical World

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Volume 72 New York, Saturday, August 3, 1918 *Number* 5

Lightless Nights and What They Involve

THE midsummer petty savings movement now being under way, we take this opportunity of suggesting some of the things which should be looked out for in carrying out the practical provisions of the situation; and the thing which we particularly want to bring to the public mind is the fact that a great many streets will prove to be insufficiently lighted when the window and display lighting is suppressed. In many instances the municipal authorities have come to lean rather heavily on this private lighting for final results, so that after the auxiliary lighting is dispensed with the street lighting proper in many thoroughfares is rather low compared with what is really necessitated by the traffic. In some cases it will probably be necessary to do more rather than less in the way of street lighting in order to take care of the great and increasing needs. There are very few cities in which the streets are really thoroughly well lighted for the purpose of their use, and cutting down public lighting is quite certain to lead to an increase of accidents, and probably of crime, in such situations. Especially is this true in chief streets where the public lights have remained unchanged for the better during a considerable period of increasing use. As we have many times reiterated, the saving in fuel by the lightless night game is rather ridiculously small; but such as it is we have it, and the only cause for apprehension is lest in the excess of zeal the municipal authorities indulge in cheese-paring economy to the public defriment.

Telegraph and Telephone Control in War

THE government is waging a war in which all our resources and our future are pledged. It deems "necessary for the national security and defense" the "supervision, possession, control and operation" of the telegraph and telephone systems. It is, therefore, assuming complete direction of these great properties and hence undertaking on a large scale what is somewhat in the nature of experiment. We hope that it will receive the same acquiescence and loyal support which are given heartily to other acts having in view the successful prosecution of the war, the centralization of such power in Washington as may be required to bring final victory to our arms.

Whatever ideas may have been held in the past, it is not the past that we are dealing with, but a present which is critical for the civilization of mankind. Those human beings who hold the most delicate and potent of the forces that will decide the issues of the war in the last quarter hour are the federal authorities at Washington, and, irrespective of other considerations, this is the moment to hold up their hands.

It may not be easy for those who have built up the great vital agencies of telephone and telegraph communication to see these properties pass from what they regard as experienced corporate control to a government department. It may be still harder to feel that the new control will be exercised by a Postmaster-General who has sought steadily to substitute government ownership for private ownership of these extensive systems. But the attitude to take is that those points are of no consequence now, that the action of the government is for the duration of the war, and while the exigency lasts it is nothing less than a patriotic duty to maintain the service at the highest possible pitch of efficiency.

Mr. Burleson and those who are associated with him in the control of the telegraph and telephone have a most trying task to perform in caring for the enormous responsibility of the Post Office Department plus the extensive new burdens which are given to them by the Presidential proclamation. The country will look not alone to them, but also to the company officials, to the rank and file, to maintain service of superior character, to prevent disruption or disorganization, physical or personal, from growing at any point.

Fortunately for everybody concerned, the telegraph and telephone companies are most emphatically not in the position of the railroad companies when the carriers were taken over. Telegraph and telephone are pretty well financed up to date. They have not broken down under the strain of unprecedented traffic as did the railroads, and they have generally continued from year to year to make improvements in advance of requirements, instead of falling five or ten years behind as did the railroads. It is, in short, an admittedly efficient machine that the government gets to control, not one broken down and ready for the scrap heap. The telephone system is highly developed from ocean to ocean, from Mexico to Canada. The telegraph situation is a little more complicated by reason of the existence of competing companies. If co-ordination of the facilities of the different companies during the period of the war will help to win the victory in France, the course of the authorities will have ample justification. It is a matter for satisfaction that no charge of profiteering has been laid against the companies. There will be reciprocated satisfaction if the authorities turn back the properties to the owners and creditors at the end

of the war, unharmed, bettered if possible, with public benefits from the experiment. May the record of faithful stewardship be marred by no one at any point in the new chapter of telegraph and telephone history!

Sag in Iron Wire Lines

THE bearing of the mechanical properties of iron and steel wire on cheap construction is self-evident. At present costs of poles and labor the natural tendency is toward long-span construction, which means fewer poles and less labor than when following the usual precedents. We have often called attention to the desirability of lengthened spans even in cases where tower construction is not to be considered, and of late years much progress has been made in this direction. The relatively high tensile strength of iron or steel wire, and particularly its high elastic limit, facilitates long-span work and the practical calculation of such spans becomes a matter of considerable importance.

A brief paper by M. D. Leslie tells the story of the solution of the long-span problem for a small plant driven by circumstances to undertake iron-wire transmission lines for light service. In the special instance dealt with, the situation was complicated by a ruling, made after the line was designed and the material obtained, fixing a minimum clearance of 20 ft. (6.1 m.) for transmission lines in rural communities. The upshot of this regulation was that it became desirable to meet it by stringing the iron conductor with about half the sag originally contemplated. The approximate calculation of the line is given in detail by Mr. Leslie. The length of span in this case was 300 ft. (91.4 m.), using No. 6 iron wire.

The practical question which had to be met was the relation of the probable strains encountered to the mechanical characteristics of the wire and the factor of safety under extreme conditions. These conditions are always the critical point in the computation of lines. The early tendency in designing transmission systems was to work along the conventional path marked out by telegraph and telephone practice, using short spacing and factors of safety relatively very large compared with those which are allowed in, for instance, a telegraph line with a score or more of wires all of which can coöperate to break poles or pull off cross-arms. As a rule line designers erred in the direction of excessive precautions, excessive merely because totally unnecessary considering the actual strains to be encountered. To plan a line mechanically so that a pole will stand stiff even if all the wires on one side of it are broken down by a load which could never reasonably be expected means much extra expense. In changing to iron or steel the factors to be considered are the actual load of wind and ice to be expected on the wires and the relation of the very high tensile strength of these wires to their weakest points, determined by flaws or joints.

The experience showed that despite the low theoretical factor of safety the practical one appeared to be sufficient. While an apparent factor of safety as low as that here indicated would not be generally recommended, it probably is in fact a good bit higher than appears on the face of the figures, since the hypothetical sleet and wind factors, although taken below conventional figures, are very likely above anything likely to be encountered in the particular region concerned. Now and then there are districts in which sleet and high winds coincide, but as a rule consultation of the meteorological records show a state of affairs considerably less dangerous than the usual conservative data indicate.

Condensers and Their Design

THE steam turbine brought with it the necessity for better condensing apparatus than had previously been necessary on account of the need for high vacuum to develop the full efficiency of the new engine. With the increasing size of units, too, came the necessity for condensation on a very large scale, which brought with it new requirements in the design of the condensers and their auxiliary apparatus. D. W. R. Morgan's paper on this subject discusses the new problems and the lines of improvement which are being followed out. The general losses which occur in surface condensers and which may produce somewhat serious effects on the economy of the plant are of three kinds—drop in vacuum through the condenser, temperature differences which tend to cool the condensate and hence to lose heat when this is, as usual, employed for the boiler feed, and finally, incomplete removal of the air, which hinders the necessary heat transfers in the condenser. The first source of loss is dependent on the general design, including the size and shape of the shell. The second likewise is a matter of close design with the object of preventing the cooling of the condensate to a point materially below the temperature of the incoming steam.

As in almost every case of engineering, meeting the two sets of conditions here noted is a matter of great skill and finesse, since to a certain extent the easy way out of one difficulty may lead straight into the other and may, too, result in large increase in the cost of the apparatus necessary to obtain given results. Extremely prompt and efficient condensation may imply lessened room for steam flow and consequent drop in vacuum. Large room for steam flow, on the other hand, may introduce too much cooling of the condensate. The third difficulty, incomplete removal of the air, is likely to be due to leaks in the system or insufficient capacity in the air pump, the result being lessening of the heat transfer and a drop in the efficiency of the condenser. Of late the steam ejector type of air pump has come into considerable use and on moderate degrees of vacuum works with great efficiency. At a vacuum as high as 28½ in. (72.4 cm.), however, the hydraulic air pump does better work. Air leakage seems to be more serious in the case of surface condensers than in the jet condensers now largely used. It will thus be seen that the air pressure problem is chiefly a matter of care in keeping the apparatus tight and in thoroughly efficient air pumps.

As the cost of condensing apparatus is no insignificant factor in the cost of plant, the determination of the condenser and its auxiliaries becomes an important feature to the engineer. A balance has to be struck between the gain in fuel by increased vacuum obtained

by rather costly apparatus as compared with the increased power and cost necessary to produce it. Mr. Morgan has a word to say, too, regarding the material for tubes. At the present costs of copper and its alloys, there is considerable to be said for steel tubes, particularly in cases where the condensing water does not involve any special risks. The thermal conductivity of the steel is obviously much lower than that of the metal ordinarily used, but cases may arise in which from the dollars and cents standpoint the cheaper metal may prove advantageous. As a final warning Mr. Morgan intimates that as a rule condensers as installed are too small for the maximum work required of them under average conditions, resulting in lowered efficiency at the very times when highest output is necessary.

A Case of Changes In Design

IT IS by no means always that an engineer can comfortably lay out a hydroelectric plant so that everything can proceed in regular order. The hydraulic portion of this proposition frequently leads to unexpected difficulties and forces a shift in design after these have developed. A good example of this contingency is given in our brief article descriptive of a plant on the Klamath River in which construction had to be adapted to things as they were instead of adhering to things as they were expected to be. The plant is of 10,000 kw. rating, transmitting at 60,000 and 34,000 volts, with an equal amount of capacity to be added. The hydraulic situation made desirable the use of a penstock system about 200 feet (60.9 meters) long, reaching from the abutment at one end of the storage dam down to the power house. The original scheme called for a single 17-foot (5.2-meter) penstock, but constructional difficulties as the case developed rendered it desirable to change to two 10-foot (3-meter) penstocks. This brought with it a train of other changes. It was intended to place the hydroelectric unit in the conventional way with the main shaft across the power house. With the adoption of two penstocks a clear waterway had to be made and the generator shaft would of necessity run the other way. By a change in the scroll case of the turbine two inlets were provided and the original runner was installed in the modified scroll case.

As regarded added equipment, it was found that the units could not be symmetrical in utilizing the situation advantageously, so the building was laid out to fit the constructional conditions. Just why anybody should consider symmetry a necessity, or even of any consequence whatever, in a station containing only two large units, it is rather difficult to imagine. A great deal of money has been sacrificed in power-house construction to an obsession of symmetry on the part of the designers. The main thing is to have a power house convenient and the generating units and equipment accessible. Sometimes this implies symmetry and at other times, particularly in the case of plants of somewhat limited capacity and few units, it does not. The distribution is somewhat interesting as being at two voltages, by the use of star and delta connections respectively, while leaving everything ready for passing to the higher voltage at very short notice. It is a rather instructive case of compulsory shift of design from causes arising after the work was initiated.

Overhauling a Hydraulic Plant

SMALL plants, and especially small hydraulic plants using auxiliary steam, provide a good field for the exercise of skill and ingenuity in operation. They do not sound big to those who reckon in thousands of kilowatts, but give extremely useful service to the community, and it is worth noting that a large part of the total available water power depends on its utilization by small plants.

A short report by C. A. Graves in another column gives an account of the improvements made in a little plant at Deposit, N. Y., which is instructive to the operator of like small stations. The plant began in a way which is familiar to collectors of electrical antiquities—three vertical wheels bevel-geared to a horizontal shaft, a jack shaft to which the generators were belted, and two steam engines to take the load when necessary, one of them of the antediluvian slide-valve variety. There was no surplus water capacity, and the average coal consumption for the six years previous was 824 tons. After a fire at the plant which might almost be considered providential in its results, things were put into efficient shape, and the jack shaft, the slide-valve engine, the old generators and the waterwheel harness were thrown into the scrap heap. Hydraulic conditions still remaining unchanged, the original wheel-shaft equipment was retained but belted directly to a 200-kw. generator. The large engine had a 250-kw. generator installed on its extended shaft, and a 50-kw. direct-connected unit was added for light-load periods and for working in parallel with the waterwheel at certain times. To help out the hydraulic plant the tailrace was thoroughly scraped out by a cable-drawn scraper, the waterwheel runners were cleaned and smoothed, and new step bearings were put in. The saving in fuel has amounted to over 600 tons per year, which at the present price of coal tells its own story of useful improvement. Such is the brief tale of what has been done in improving one plant of a type of which there are hundreds needing improvement.

The Coming Issues

FEATURES of a new hydroelectric plant serving an interconnected system in the Middle West will be presented shortly, to be followed by a description of the entire system from the interconnection point of view. The second installment of the Bureau of Standards' contribution on iron wire will dwell on the mechanical characteristics of solid and stranded iron wire. Professor Clewell's next article will refer to the selection and installation of motors and control apparatus in the woodworking industry. Other articles will be published regarding outdoor substations and war-time operation of motor-driven pumps.

Sag Calculation for Iron-Wire Lines

Stringing of Iron Wire with Less Sag Is Suggested as a Practicable War-Time Economy Where the Usual Safety Factor Is Not Essential and Weather Conditions Are Not Severe

BY M. D. LESLIE
Chief Engineer Midland Water, Light & Ice Company, Dodge City, Kan.

AFTER designing a transmission line and purchasing the material, the Midland Water, Light & Ice Company was forced to change the design to comply with a new ruling of the Public Utilities Commission fixing minimum clearance for transmission lines in rural communities at 20 ft. (6.1 m.). The company was forced to string the wires with 3.5-ft. (1.07-m.) sag on 375-ft. (114-m.) spans (No. 6 B.B. iron wire), instead of 6.9 ft. (2.1 m.) at 60 deg. Fahr., as originally planned, because additional poles for shorter spans could not be obtained. Experience with this and other lines has led the writer to believe that the usual factors of safety allowed for iron-wire lines for less important service are unnecessarily high where the weather conditions are not severe. The economy effected by less rigid design, moreover, is in keeping with war-time requirements.

It appears that some companies have not taken full advantage of the properties of iron wire when compiling their sag tables. For instance, in some tables hard-drawn copper and iron wire are allowed the same sags for corresponding temperatures and spans. The fact that iron wire has a higher modulus of elasticity and a lower coefficient of expansion than hard-drawn copper makes a considerable difference in the sags allowable with the two different materials. The Midland company has been using a modulus of 24,000,000 and a coefficient of 0.0000064 for iron against a modulus of 16,000,000 and a coefficient of 0.0000096 for hard-drawn copper.

A Useful Formula Applied

After failing to find in any of the existing tables the information necessary for stringing iron wire under local conditions an attempt was made to work out a solution from elementary formulas, but the standard formulas proved inadequate. Eventually a useful formula derived by K. L. Wilkinson was found in the ELECTRICAL WORLD of Feb. 6, 1915. It is a cut-and-try method but served the purpose well. For the benefit of persons who may be unfamiliar with this formula calculations for the Bucklin-Dodge City line are reproduced herewith. The length of span is 300 ft. (91.4 m.); the size of wire No. 6 E.B.B. iron, the weight 0.109 lb. (0.049 kg.) per foot, the area 0.032 sq. in. (0.206 sq. cm.), the modulus of elasticity 24,000,000, the coefficient of expansion 0.0000064, and the maximum loading is 0.7 lb. (0.317 kg.) per lineal foot. This load corresponds approximately to ½ in. (1.27 cm.) ice and 4 lb. (1.81 kg.) wind pressure, or 30 miles (48.3 km.) actual velocity, which is considered ample for this territory. The stress allowed was 1310 lb. (594 kg.) or 70 per cent of the ultimate strength of the wire. The N. E. L. A. crossing specifications advise 50 per cent of the ultimate strength, but for reasons which will be explained later 70 per cent to 80 per cent of the strength of the wire is used.

Calculating the sag under loaded condition:

$$D = (W_1 \times L^2)/(8 \times T), \text{ or } D_1 = [0.7 \times (300)^2]/(8 \times 1310) = 6 \text{ ft. (1.83 m.)}$$

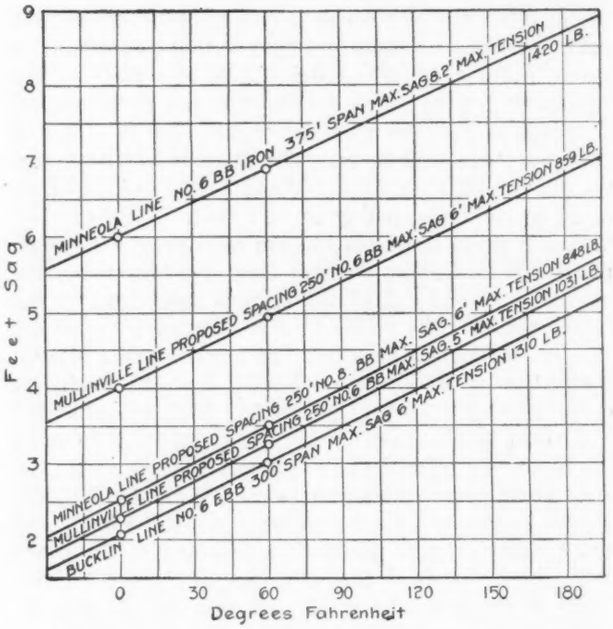
For the length of conductor per foot of span:

$$L_1 = 1 + (8 \times D^2)/(3 \times L^2) = 1 + (8 \times 6^2)/[3 \times (300)^2] = 1.001065.$$

For the unstressed length of conductor per foot of span:

$$L_0 = L_1 - (T_1 L_1)/(MA)$$

$$L_0 = 1.001065 - (1310 \times 1.001065)/(24{,}000{,}000 \times 0.032) = 0.99936.$$


MINNEOLA LINE NO. 6 BB IRON 375' SPAN MAX. SAG 8.2' MAX. TENSION 1420 LB.
MULLINVILLE LINE PROPOSED SPACING 250' NO. 6 BB MAX. SAG 6' MAX. TENSION 859 LB.
MINNEOLA LINE PROPOSED SPACING 250' NO. 6 BB MAX. SAG 6' MAX. TENSION 848 LB.
MULLINVILLE LINE PROPOSED SPACING 250' NO. 6 BB MAX. SAG 5' MAX. TENSION 1031 LB.
BUCKLIN - LINE NO. 6 E.B.B. 300' SPAN MAX. SAG 6' MAX. TENSION 1310 LB.
Feet Sag
9
8
7
6
5
4
3
2
0
30
60
90
120
150
180
Degrees Fahrenheit

SAGS USED ON SEVERAL IOWA IRON-WIRE LINES

The formula for determining the sag at zero deg. Fahr. is:

$$D_2^3 + D_2(3 \times L^2)/8 \times (1 - L_0) = 3W_2L^2L_0/64MA, \text{ or}$$

$$D_2^3 + D_2(3 \times 300^2)/8 \times (1 - 0.99936) = (3 \times 0.109 \times 300^2 \times 0.99936)/64 \times 24{,}000{,}000 \times 0.032$$

In this formula the length of the wire is the only value which changes in the various calculations so the rest is reduced to definite values and used as such.

Calculating the sag at zero temperature unloaded,

$$D_2^3 + D_2 \times 33{,}750\ (1 - L_0) = 53.93L_0$$

$$D_2^3 + D_2 \times 33{,}750\ (1 - 0.99936) = 53.93 \times 0.99936$$

$$D_2^3 + D_2 \times 21.6 = 53+$$

For first approximation substitute 2.05 for D_2, giving $(2.05)^3 + 2.05 \times 21.6 = 53$. Therefore the sag at zero deg. Fahr. unloaded is 2.05 ft. (0.625 m.) and the stress in the wire is $L^2W/8D = [(300)^2 \times 0.109]/(8 \times 2.05) = 598$ lb. (271 kg.).

For 60 deg. Fahr.:

$$L_{60} = L_0(1 + 60 \times 0.0000064)$$

$$L_{60} = 0.99936(1 + 60 \times 0.0000064) = 0.99974$$

For the sag:

$$D_2^3 + D_2(33{,}750)\ (1 - 0.99974) = 53.93 \times 0.99974$$

$$D_2^3 + D_2(8.77) = 53+$$

Substituting 3 for D_2,

$$27 + 3 \times 8.77 = 53$$

Hence D_2, the sag at 60 deg. Fahr., is 3 ft. (0.914 m.). The stress is $[(300)^2 \times 0.109]/(8 \times 3) = 410$ lb. (186 kg.).

In like manner the sag at 120 deg. would be 4.1 ft. (1.25 m.) and the stress 300 lb. (136 kg.). At 30 deg. below zero unloaded the sag would be 1.7 ft. (0.518 m.) and the stress 720 lb. (326 kg.).

According to L. P. Perry's tables (ELECTRICAL WORLD, Oct. 13, 1917) the sag at 60 deg. for a 300-ft. (91.4-m.) span should be 10 ft. (3.05 m.), whereas by Wilkinson's formula, with Class B loading and allowing a tension of 50 per cent of the strength of the conductor, the sag at 60 deg. would be 8.3 ft. (2.53 m.). However, the formulas used appear to be suitable for the conditions involved since the lines were mostly on private right-of-way and extended through territory where the usual safety factors are not required and where weather conditions are not severe. Apparently there is no reason why iron wire should not be worked up to 75 per cent of its strength under such conditions.

The accompanying curves give the sag for various span lengths which have been developed for construction or proposed work. It may be noted that the values calculated give straight-line sag curves for the various temperatures.

OBSERVATIONS MADE UNDER OPERATING CONDITIONS

Referring to the Dodge City-Minneola curve, it may be observed that the sag on these 375-ft. (114-m.) spans calls for 6.9 ft. (2.1 m.) at 60 deg. As already stated a new ruling of the Public Utilities Commission necessitated reducing this sag to 3.5 ft. (1.07 m.). This line had not been subjected to winter conditions up to the time this article was written, but the wind pressure has been very high at times. Some breaks have occurred due to faulty joints or defects in the wire, but they did not occur during storm periods. The Bucklin line has withstood heavy winds, accompanied by severe cold and some sleet, which disabled many of the neighboring telephone lines. Several failures on this line occurred during the first months of operation, due entirely to defective wire.* It is not anticipated that the Minneola line will fail under similar conditions even though the sag is about the same in these 375-ft. (114-m.) spans as for the 300-ft. (91.4-m.) spans on the Bucklin line. It is possible that the first cold weather will reveal a few more weak places, but after these have been remedied it is expected that the line will stand without any further trouble.

As an experiment, one mile (1.6 km.) of No. 6 B.B. iron wire was strung in the fall on poles spaced 412 ft. (125.6 m.) apart and pulled tight, practically without sag. This line withstood a temperature below zero and high winds without failure or apparent damage to the wire. Telegraph companies using No. 6, No. 8 and No. 10 B.B. iron wire on 125-ft. to 150-ft. (38.1-m. to 45.7-m.) spacings (which, according to Mr. Perry's tables, should have, 16 in. (40.5 cm.) sag at 60 deg.) pull all sizes to the same level, which is practically at zero sag. They have been doing this for twenty-five years or more with apparent satisfaction. Transmission companies in the state have also been operating No. 8 and No. 6 iron wire on 300-ft. (91.4-m.) spans with 18-in. sag for two or three years, and they reported no trouble even through the severest weather conditions of last year.

Why, then, should 300-ft. (91.4-m.) spans be strung with 10-ft. (3.05-m.) or 8.3-ft. (2.53-m.) sags if 3.5 ft. (1.06-m.) or even 1.5 ft. (0.45 m.) will be sufficient?

While the disregard of established engineering principles is not advocated, it appears that present practice is too conservative. Possibly the trouble lies in the fact that the maximum loading conditions are seldom if ever reached. Never in the history of the weather bureau in this locality has a 60-mile (96-km.) wind been recorded during sleet periods, although this district is included in the section for class B loading. On the contrary, the records show that during sleet periods the temperature is usually above zero with little wind prevailing. Theoretically it was impossible for the test line referred to above to stand under winter conditions, but it did.

CONCLUSIONS

The conclusions deduced from these investigations are as follows: The strength of commercial iron wire is equal to or above its estimated strength except for occasional flaws. These flaws are cut out as far as possible during stringing. Those that are missed soon appear after the wire has been in service a short time, and it is preferable to get them out of the line rather than to try to cover them up with a high margin of safety. Wire is strung according to the results given by the foregoing formulas and loading conditions unless it is found that this interferes with prearranged construction plans. In this case a compromise is effected to meet the requirements of the commission rulings and the risk of breakdown is assumed. One reason for doing this is that many breakdowns are not anticipated, and another is that if they do occur it is better to have the interruptions than to pay interest on the largely increased costs necessary to install the wire with heavy sags on poles high enough to meet the required clearances.

During the operation of the Bucklin line, observed over a year, and of the Minneola line, observed over six months, the towns served have never been out of service on account of wire failure. A certain number of interruptions occur owing to broken insulators, faulty joints, transformer and fuse troubles, but the small communities served are not exacting in their requirements of continuous service.

It should be remembered that the lines considered in this article are comparatively long and serve very small communities, so that items such as pole spacing and height make a considerable difference in the feasibility of such extensions. The climate in this territory, moreover, is mild and the conditions of service are not severe. These facts should be thoroughly considered before making use of any of the radical suggestions prompted by the experiences outlined in this article.

*Since this article was written, however, the Minneola line has withstood heavy wind and sleet without failure.

Motor Drive in Paper and Pulp Mills—II

Need of Suitable Protective Equipment Where Power Demands Are Erratic—Motor Characteristics Required for Specific Operations—Operation of Jordan Engines and of Calenders

BY C. E. CLEWELL
Assistant Professor of Electrical Engineering, University of Pennsylvania

OF THE variety of paper and pulp machines which are well suited to motor drive, there are quite a number which require large motors and whose starting requirements under certain conditions may be very severe. In fact, heavy-duty machines are recommended when specifications are made covering the motors for such mills[1].

With particular reference to the paper and pulp mill industry, Wallace points out that certain structural

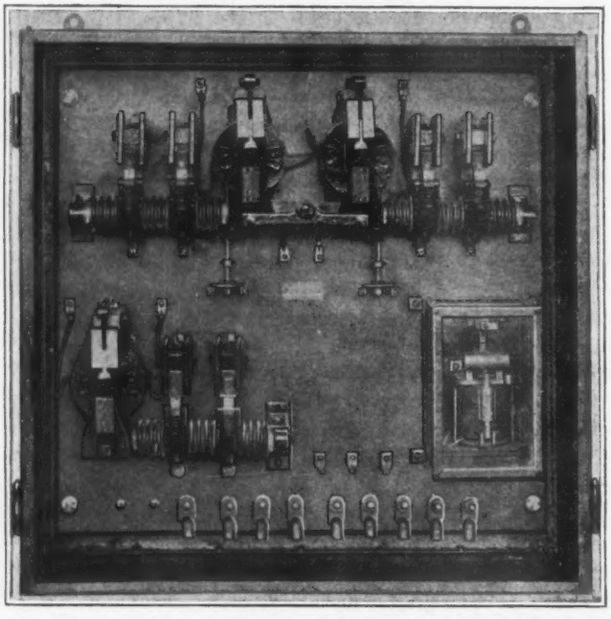


FIG. 1—REVERSING CONTACTOR PANEL USED WITH PAPER AND PULP MILL PLATER

features should be given special attention in designing motors. For example, form windings are recommended and mechanical attachment of the rotor bars to the short-circuiting end rings of squirrel-cage induction motors must be carefully considered. Another important item is the use of insulation on the motor windings which is capable of withstanding moisture. The importance of this element is clearer after an inspection of some of the processes in pulp mills as illustrated in the preceding instalment, where the wet conditions in certain departments of the mill impose unusual requirement upon the motor structure. A temperature rise of not more than 40 deg. C. is advocated for continuous operation, and the recommendation is made that the motors for this class of service should be capable of operating continuously with an overload of 25 per cent.

[1]See article by Joseph H. Wallace, "Standard Handbook for Electrical Engineers," fourth edition, p. 1272, to which several references have been made in the preparation of this article. Other sources of information consulted include the paper by W. W. Cronkhite, *General Electric Review*, May, 1917, p. 384, particularly in reference to motor applications for Jordan engines, calenders and platers, and to the paper by W. L. Merrill, *Trans. A. I. E. E.*, Vol. 34, Part I, p. 1340.

Turning now to the subject of suitable control for paper and pulp mill machinery, it is desirable to consider a few of the characteristics of such machines in their relation to the control problem. The starting characteristics required of the motors employed follow in a general way those which have been discussed in earlier articles relating to other applications, except, perhaps, under the unusual conditions sometimes encountered in the operation of pulp-mill apparatus.

In the operation of those machines where pulp stock is involved, as in beaters, where the stock may settle and harden, a fresh start of the machine may require not only an excessive torque to break up the stock, but considerable care may also be desirable in "coaxing" along the mechanism from the mechanical point of view until it reaches normal operating conditions again. Such circumstances make it desirable to design the resistance grids for slip-ring motors rather liberally to meet the maximum demands likely to be placed on the motor.

With conveyors and log hauls it is not only important to use liberal rotor resistance for the slip-ring induction motors commonly employed, as a safeguard when slow starting is required or when it becomes necessary to break up a jammed condition due to ice formation, but a belt connection is depended upon to slip in case of clogging. Beaters and washers also require liberal resistance design in the starting controller for the slip-ring motors used, belt connection making it possible to place the motor at some distance from the machine, as when in a basement, and adding flexibility to the mechanical system. When a chain belt is used in such cases it should be sufficiently large to offset its tendency to act as a rigid connection between the motor and the driven machine.

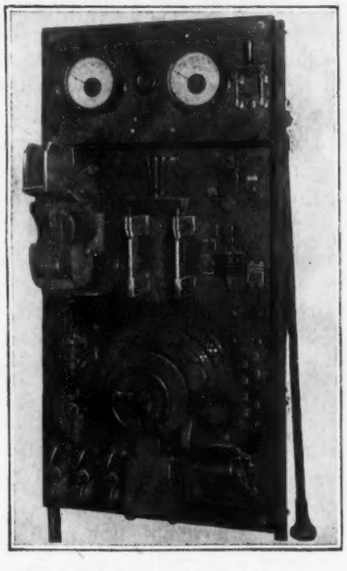


FIG. 2—AUTOMATIC MOTOR-OPERATED CONTROL PANEL

For certain processes, such as the operation of wet machines, where the use of a low speed is essential at times, the slip-ring motor is employed with high auxiliary resistance. In a few cases, typified by super-calenders and rotary cutters, the direct-current adjustable-speed motor is adapted to the conditions of operation. In a general

way, therefore, it is apparent that the control problem possesses features which are very closely related to the successful handling of the machines in such mills and that good judgment and proper allowances for abnormal loads are factors which enter into the controller design considerably more perhaps than where the load conditions are subject to a more definite de-

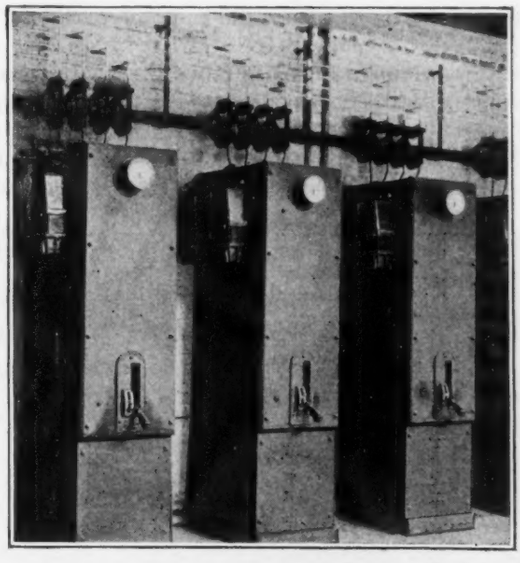


FIG. 3—SOME STARTING PANELS FOR 100-HP. INDUCTION-MOTOR-OPERATED BEATERS

termination. The accompanying illustrations indicate tendencies in the manufacture of such controllers.

SWITCHING AND PROTECTION

Special care is recommended for the selection of switching apparatus in these motor installations, and protection from overloads is advocated in the form of automatic devices. An indicated by the horsepower requirement in the table printed in Part I of this article, many of the machines must be driven by motors of large size, and hence the use of fuses may involve quite an expense for renewals when the larger sizes are required. A form of protection which has proved successful is that of oil-type switches equipped with low-voltage and overload release.

From the standpoint of mechanical safety, the elements in the transmitting mechanism between the motor and the machine must be sufficiently strong not only for maximum load conditions but also for the sudden jars to the equipment associated with the operation of much paper and pulp mill machinery. With large motors, when operating under unusually heavy load conditions, a three-bearing (rather than two) arrangement is advocated. Mechanical strength in belts and rope drives is essential. The greater rigidity of the mechanical coupling formed by silent-chain drives makes a high safety factor of still greater importance.

ADJUSTABLE-SPEED MOTOR APPLICATIONS

Because of its somewhat limited field in the paper and pulp industry, the adjustable-speed motor does not assume the importance here that it does in machine-shop work. However, several examples of its use will be given to illustrate some of its applications. In one case a 150-hp. five-to-one speed-range adjustable-speed motor is used to drive a line shaft from which a six-cylinder board machine is operated. Some idea of the power requirements of such machinery may be gained by the following data based on published figures for the multi-cylinder board equipment. There are two parts to the power required for this machine, one of which is a constant and the other an adjustable speed drive. Taken together, from about 0.012 hp. to 0.015 hp. is required per inch (width) per foot per minute (speed), the adjustable speed end alone, referred to in these illustrations, taking a little more than half the amounts just given. These figures refer to brake rather than indicated horsepower.

An example of one of the smaller applications of the adjustable-speed motor is its use for the operation of paper-mill winders and coating machines (Fig. 4). When direct-current motors are employed in super-calender operation (Fig. 5C) to obtain the very low speed (about 10 per cent normal) required in the so-called threading operation, stable operation is sought by means of field control, together with a resistance connected as a shunt across the armature terminals. This scheme has been found to be satisfactory, provided that the load is uniform during the operation of threading; but such an ideal condition is not common. Other aspects of the low-speed operation of such machinery are touched upon below in the discussion of super-calender operation.

JORDAN ENGINES

Turning now to several of the specific applications of motors in the paper industry, additional features involved in the use of the motor under extreme operating conditions will be brought out[2]. The first of these relates to the Jordan engine, one case being shown in Fig. 5. The horsepower required to drive such machines ranges from about 50 to 300, the motors in Fig. 5 being 150 hp. each and of the induction type.

The Jordan engine is a type well suited for direct

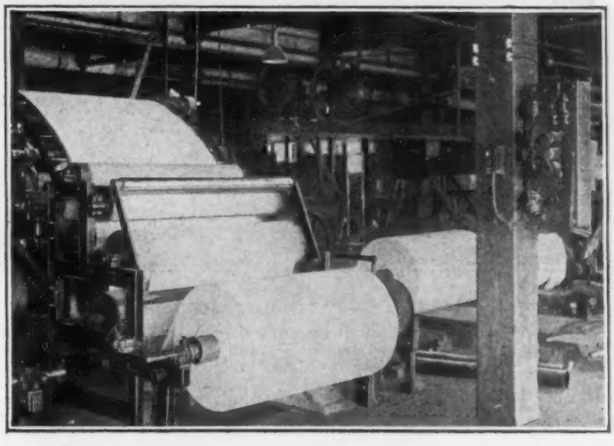


FIG. 4—COATING MACHINE WITH WINDER DRIVEN BY 10-HP. AND 5-HP., 1500-R.P.M. DIRECT-CURRENT ADJUSTABLE-SPEED MOTORS RESPECTIVELY

motor drive since the connection between the engine and motor is through a so-called telescope coupling for taking up the motion of the plug of the Jordan. This mo-

[2]Motor applications for paper and pulp mill beaters and grinders were described in Part I of this article in a preceding issue.

tion may also be provided for by a motion of the motor to and away from the Jordan on a special sliding base as in Fig. 5. In the refining action of the Jordan on paper stock, the pressure of this plug in rotating within the case of the engine has a good deal to do with the results on the product. Hence a graphic wattmeter or even indicating wattmeter readings on the motor may be employed as an indication of the way in which the refining operation is being carried on, this being true because of the dependence of the power required upon the pressure of this plug in its case.

In starting the Jordan it is not usual to apply the working load until the machine is up to speed; thus only a low-effort starting torque is required to overcome the load, which is made up principally of friction. Consequently the Jordan is a type of machine to which a self-starting synchronous motor may be applied satisfactorily in case its use is warranted from the standpoint of power factor. A reference to Fig. 5 shows that the use of the moving motor scheme of coupling the machine and the motor together calls for a certain amount of play by the motor on its base as the plug moves to and fro. Special telescope couplings, which allow for this motion by the sliding of the two ends of the coupling on each other, allow use of a rigidly fastened motor.

The power requirements depend on the size of the machine, the nature of the paper pulp which is being handled, and on such factors of operation as the position, pressure and speed of the plug used to refine the pulp. Large differences in the power required to operate a given size of Jordan in two mills may be due to the extra demand placed on the Jordan in one case because of inadequate beater capacity, the Jordan thus being called upon partly to reduce the pulp and partly for refining.

The three views in Figs. 5B, C and D show various applications of the motor to calenders, Fig. 5B referring to a 50-in. (1.3-m.) nine-roll stack paper calender. In this view the two motors are shown, one large for regular operation and one small for threading. The control panel (rear view) is seen to the right. A group of four motor-driven super-calenders is shown in Fig. 5C, and another view of individual motor operation is shown in Fig. 5D, this being a single-motor direct-current equipment in comparison with the two-motor outfit (Fig. 5B).

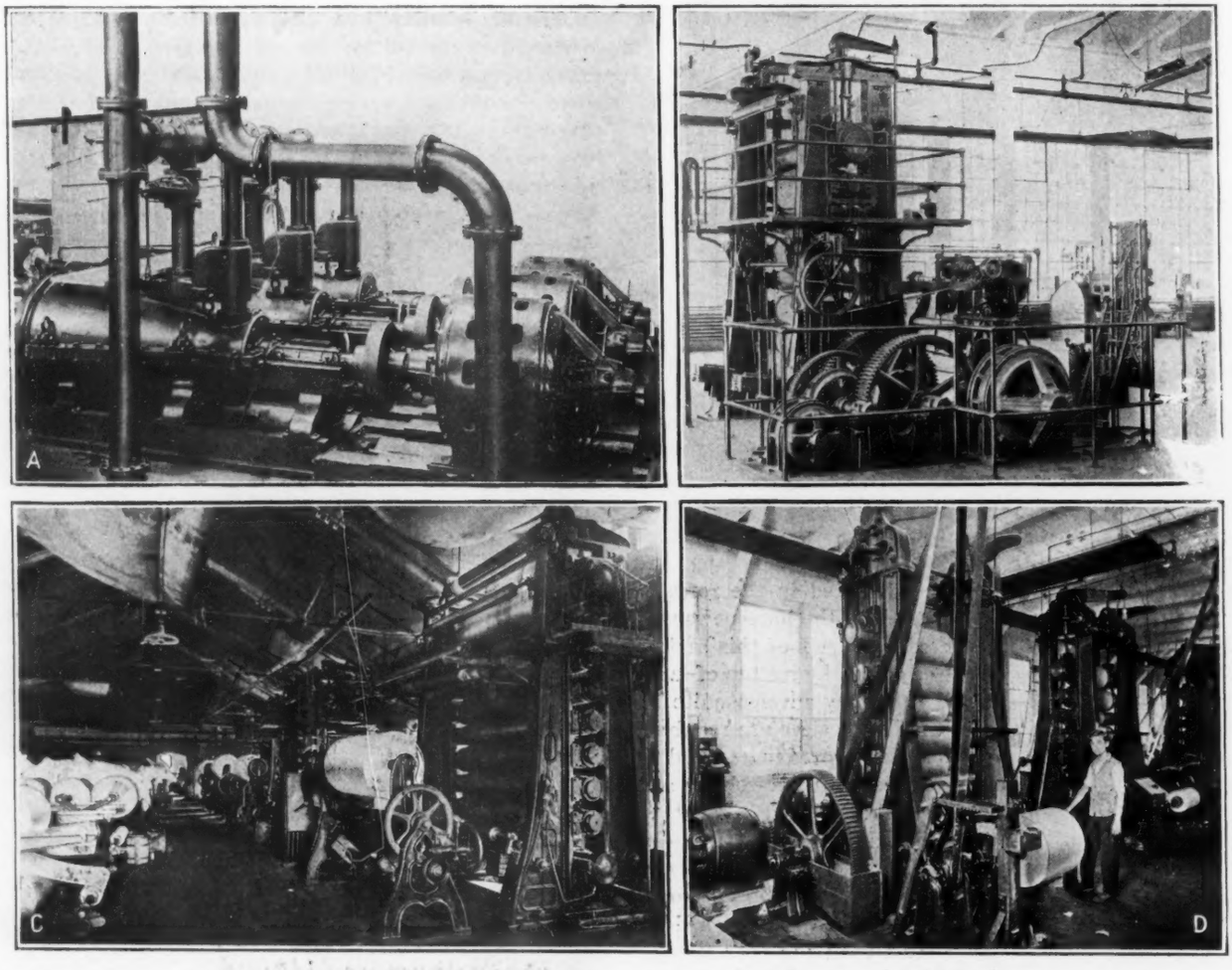


FIG. 5—PAPER-MILL JORDANS, CALENDERS, SUPER-CALENDERS AND FINISHING CALENDERS

A—The three Jordans shown are driven by 150-hp. induction motors. B—A 75-hp. and a 7½-hp. motor operate this 50-in. (1.27-m.) nine-roll calender. C—Four motor-driven super-calenders. D—Individual motor drive applied to finishing calenders.

As previously mentioned, the unusually low speed at which these machines must operate for roughly one-fifth to one-third of the time—that is, on the order of one-tenth the normal speed—imposes peculiar condi-

tions on the motor equipment. This low speed is required as the paper is threaded through the stack of rolls, and this low speed should be fairly stable throughout this part of the operation. From the standpoint of speed, therefore, two widely different values are required, and for each of these practically constant-speed operation is essential. The older practice was to make use of one motor (direct-current in Fig. 5 D) arranged for field control and of a special shunt connection across the armature. A scheme preferable to this method is to use two motors—one small and one large. Often the induction type is selected because so many plants are equipped with alternating current. The smaller unit operates normally at one-tenth of the speed of the large motor and is used for the threading operation. After the paper is threaded through all of the calender rolls, the larger motor is thrown in at the higher speed.

The connection of the larger or smaller motor into the circuit, as just described, may be done by one or more push-button stations. In the modern equipment the control apparatus for two-motor operation includes three push-buttons, one of which starts the larger motor automatically, a second stops the large motor and starts the small motor, and a third brings either to a quick stop. The push-button scheme may be operated in conjunction with a controller, and in starting the motor by the push-button its speed is then governed by the position of the controller. Fig. 5 B shows one of these completely automatic control equipments, the larger of the two motors in this case being accelerated by automatic means instead of by a hand-operated controller.

Speed control and reversal (ten to thirty reversals per minute, depending on the work done) of platers is oftentimes accomplished by remote control too. The controller, which is usually mounted on the plater, actuates contactors on a separate panel.

Construction Problems at Copco Plant

Extensive Changes Made in Design After Work Was Started on This Hydroelectric Installation on the Klamath River, in Oregon, Increased the Natural Difficulties of Work in Narrow Canyon

LIMITATIONS of space and the necessity of providing for extension without interruption called for unusual care in interior arrangement of the Copco plant of the California-Oregon Power Company, which was recently put in service on the Klamath River, Oregon. The difficulties of the work, however, were greatly increased by the fact that radical changes in the original design, made after the work was under way, necessitated rearrangement and even redesign of important features as the work progressed.

The plant has an installed capacity of 10,000 kw. and is laid out to provide for the addition of another 10,000-kw. unit without interrupting operation. The capacity of equipment which it was deemed economical to install was based on a normal minimum stream flow of about 1000 sec.-ft. (28.3 sec.-m.) and a reservoir of 1500-acre-feet (185 hectare-m..). This amount of storage is available behind the dam at its present height of 110 ft. (33.5 m.). An additional 16 ft. (4.9 m.) can be added if desired; in fact, the headworks were laid out with that in mind. The dam has a gravity section, is set in the narrowest section of the canyon, and its entire top can be used as a spillway.

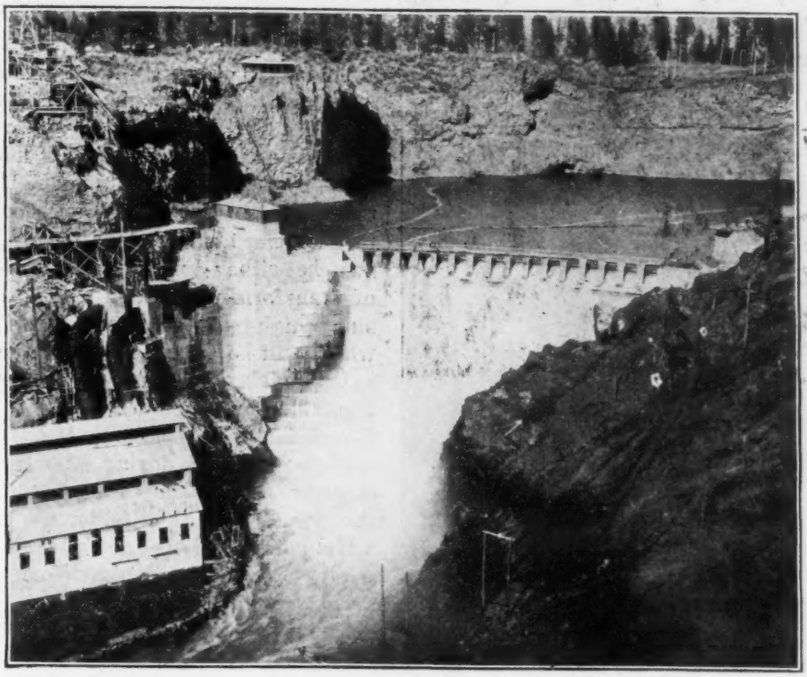


FIG. 1—GENERAL VIEW OF POWER HOUSE AND IMPOUNDED WATER

The power house will be lengthened on the downstream end when the 10,000-kw. unit is added. The gatehouse on the dam is at a height sufficient to allow for raising the dam 16 ft. (4.9 m.).

The headworks for the plant are located in a massive concrete abutment at one end of the dam. Four remote-control motor-operated gates close openings 4 ft. by 10 ft. (1.2 m. by 3 m.) in size at the throat. The distance of about 200 ft. (61 m.) from the gates to the power house is spanned by two 10-ft. (3-m.) penstocks which enter the power house at roof level on an angle of 35 deg. with the horizontal. The two penstocks were substituted for the original design of a single 17-ft. (5.2-

m.) pipe because of the difficulties of supporting the great weight of the single penstocks at roof level and other attendant problems of arrangement.

The twin-runner waterwheel is rated at 18,600 brake hp. under a 125-ft. (38.1-m.) head at 200 r. p. m. The original plan was to place this turbine and the 10,000-kw., 2300-volt generator to which it is directly connected with the main shaft at right angles to the axis of the building. When a change was made to the twin-penstock line, however, it became necessary to place the unit with the main shaft parallel to the center line of the building in order to obtain the necessary space. When this decision was reached the turbine had already been delivered at the site. It was found possible, however, to redesign the scroll case and provide for two inlets 8 ft. (2.4 m.) in diameter.

The power house was built as close to the dam as was consistent with a reasonable amount of excavation of the canyon wall. On the stream side a bulkhead was necessary to prevent stream currents from interfering with the flow in the tailrace.

After much detailed study it was considered impracticable to lay out a power house in such way that after the future addition the final grouping of units would be symmetrical. Exciter units were placed at the generator end of the main unit, and an additional 15 ft. (4.6 m.) was added to the width of the power-house floor in the main room to provide space for assembly and repair of equipment.

The height of the traveling crane required for handling the machinery was lower than the top of the penstocks where they enter the power house. It was not considered justifiable to give the building the additional height that would permit the crane to travel over the

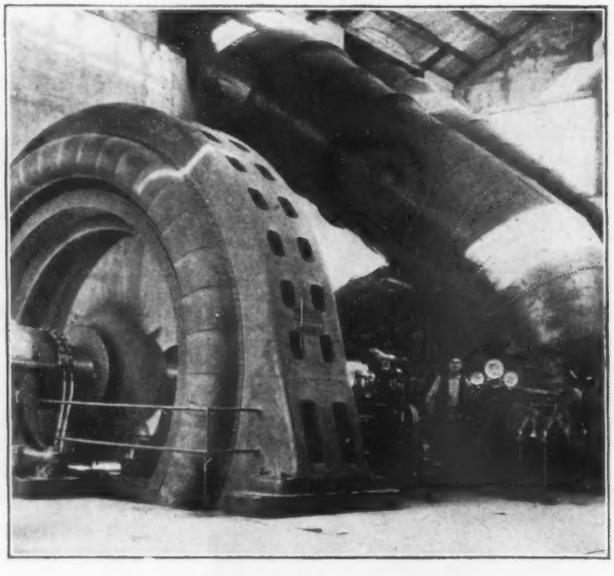


FIG. 2—10,000-KW. UNIT NOW IN SERVICE

penstocks, so the crane serves only the electric end of the unit. In the duplicate unit the water will probably enter through tunnels so that the traveling crane track can run the entire length of the addition.

The exciter turbines are supplied by an 18-in. (45.6-cm.) pipe tapped into one of the 10-ft. (3-m.) penstocks just outside the power-house wall. This pipe runs vertically down the wall and comes up through the floor to the turbine runner. The exciter supply pipe also furnishes cooling water for transformers and bearings.

In a lean-to, built as an addition on the river side of the power house as originally designed, are the transformers. To avoid the necessity of providing the head room required by high-tension bus clearance, the bus-

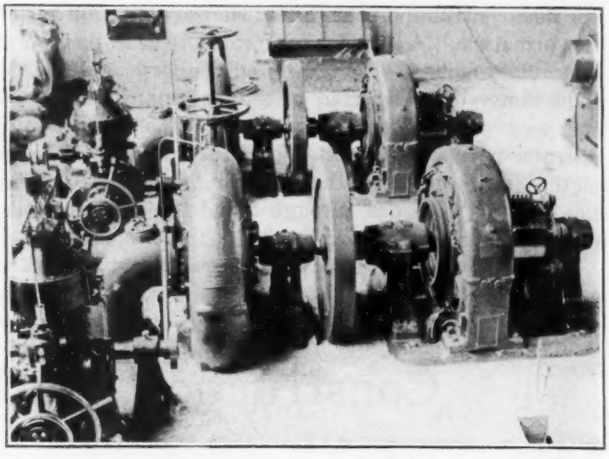


FIG. 3—EXCITER UNITS WITH FLYWHEELS AND GOVERNORS

bars are carried beneath the lean-to in conduit and the conduit is of sufficient size to provide for additional lines when the duplicate unit is added. Thus the size of the lean-to was kept down to the minimum required by the transformer alone. To compensate for the light shut off by this lean-to structure, every available space was used for windows.

This plant is located near the geographical center of the company's system, and for the present it is required to supply both the 60,000-volt and the 34,000-volt systems. By star and delta connections 60,000 volts is delivered by one bank of transformers and 34,000 by the other bank. By the use of an oil switch between each transformer bank and the generator the installation was so made that when the duplicate unit is put in the ultimate arrangement for all 60,000-volt delivery can be made by simply changing connections and without disturbing the installed oil switches or transformers. With the contemplated combination of disconnector and oil switches either generator will be able to feed either bank of transformers through a 2300-volt transfer bus. A single high-tension outdoor oil switch has been installed which will be duplicated when the new unit is put in.

Ultimately the high-tension lines will leave the power house on the up-hill side and go over the cliff above. Because of the desirability of having this space free of high-tension lines during later construction operations, however, the leads are temporarily taken directly across the river, where they follow the other bank up stream a few hundred yards and then recross. These two temporary crossings were considered worth while solely to avoid the interference with later construction.

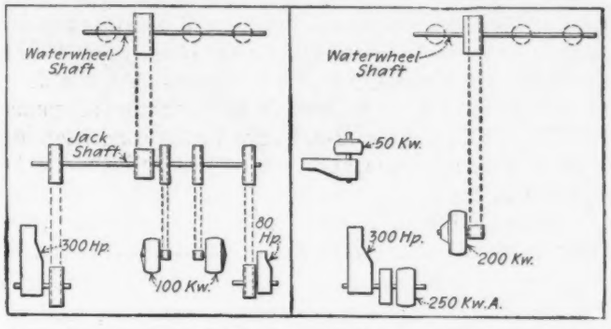
The waterwheels and governors were made by the Allis Chalmers Company and the electrical equipment was supplied by the General Electric Company. The construction was carried out by the California-Oregon Power Company forces, P. O. Crawford being resident superintendent in charge of construction and installation.

UTILIZE DRY SEASON TO OVERHAUL WATERWHEELS

Waterwheel Runners, Bearings and Gates, Alignment of Bevel Gears and Shafts Should Receive Particular Attention

BY C. A. GRAVES

THE summer term, with its usual dry season, should be utilized by the operators of many low-head water-power plants to plan for overhauling their waterwheel equipment, so that it may be made more efficient in the use of the water and thus reduce the amount of coal used for auxiliary power. The principal points



FIGS. 1 AND 2—LAYOUT OF EQUIPMENT BEFORE AND AFTER REHABILITATION

to which attention should be given are the waterwheel runners, bearings and gates and the alignment of the bevel gears and horizontal shaft.

The runners, after several years' service, become roughened with rust and blisters, which reduce the efficiency of the turbine by preventing the smooth flow and discharge of the water. Therefore, the runners should be removed from the casing and cleaned. At the same time, the bearings should be inspected and the gates should be adjusted so that they will close uniformly. The continual vibration often noticed in waterwheel harness may be prevented by lining up the shaft and the gears, and this will reduce the loss of power in bearing and gear friction. The tailrace should also be cleaned out, and in many cases it would be of decided advantage to dig it deeper, so that full advantage may come from the maximum net head of the water.

As an example of what can be done in this line, experience at the plant of the Southern New York Power Company, on the Delaware River, at Deposit, N. Y., may be related. Previous to 1914 the power plant consisted of three 42-in. (1.06-m.) vertical waterwheels connected through bevel gears to a horizontal shaft. To this shaft was belted a jack shaft, and to the latter were belted two 100-kw. generators. At one end of the shaft was also belted a 300-hp. four-valve engine, and at the other end an 80-hp. slide-valve engine. The arrangement is shown in Fig. 1. With this plant the average coal consumption for the six years previous was 824 tons per year and there was no surplus water-power capacity.

In 1914, after a fire at the plant, the following changes were made: The jack shaft, the 80-hp. engine and the two generators, as well as the waterwheel harness, were junked, and in their places were installed a 250-kva. generator on the extended engine shaft of the 300-hp. engine, a 50-kw. direct-connected unit, a new harness junked, and in their places were installed a 250-kva. generator, belted to this shaft.

The tailrace was cleaned out by a unique method; that is, a scraper was drawn by a cable back and forth through the race, the cable being passed over a motor-driven drum. The scraper was handled by a man who walked behind it, and some of the time he was up to his waist in water. The waterwheel runners were cleaned and smoothed and new step bearings were installed.

With the new installation the average coal burned for the last three years has been 200 tons yearly, and this with an increased output equivalent to a 30 per cent increase in revenue. The power generated was not recorded prior to 1914, so that no comparison can be made between the power generated and the fuel consumption or the stream flow; but there is now a considerable surplus of water power available. The saving in fuel has been over 600 tons a year, or 75 per cent.

A large part of the saving is due to the improvement in the waterwheel equipment and the elimination of the jack shaft, in that a much larger amount of power was obtained in the dry season. Another saving is due to the method of operating the small steam engine unit in parallel with the waterwheel and making the larger waterwheel unit carry the wattless current while the 50-kw. unit operates at 100 per cent power factor. Still another saving is due to the elimination of the long steam line by keeping the engines close to the boilers. The water in one of the boilers is kept hot at all times so that the steam pressure can be raised to 100 lb. (7 kg. per sq. cm.), if necessary, within thirty minutes. This is accomplished, when there is plenty of water power, by keeping a small fire on the grate during cold

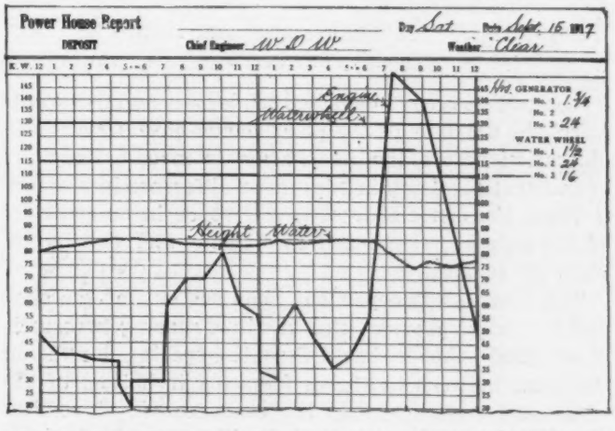


FIG. 3—HOW WATERWHEEL OPERATION AND ENGINE OPERATION WERE CO-ORDINATED

weather, and at other times by starting a fire once a week, generally Saturday afternoon, in anticipation of the peak load, and then closing the dampers and keeping the heat in the boilers.

A gage has been installed in the forebay, and periodical readings of the height of the water are taken. The readings are charted hourly in the form of a curve. Full advantage is taken of any increased flow due to showers up the river. The curve also can be used by the operator to determine whether to run the large or the small engine during the peak-load period.

Recent Developments in Condensers

Necessity for Efficient Air Removal in Surface Condensers—Relative Advantages of Steam Air Ejectors and Hydraulic and Reciprocating Air Pumps—Increasing Use of Jet Condensers for Large Units

BY D. W. R. MORGAN

MANUFACTURERS of condensing equipment have put forth strenuous efforts to develop highly efficient air removal apparatus, not because the present type of air pumps have failed, but to obtain the same results with a higher degree of efficiency. They have discovered that within a certain range of vacuum

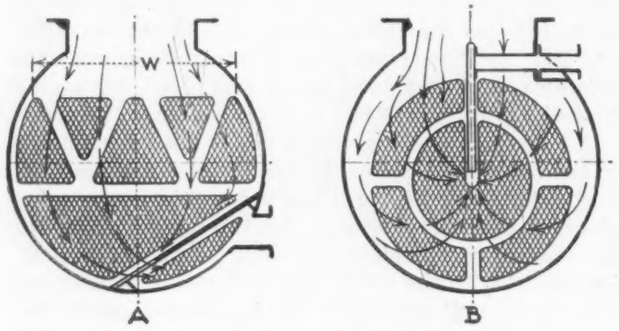


FIG. 1—CONVENTIONAL DESIGN OF SURFACE CONDENSER AND THE RADIAL-FLOW TYPE

the steam air ejector has a higher efficiency than any of the previous types of air pump. However, if a vacuum of 28.5 in. (82.4 cm.) or higher is desired, the steam consumption of the ejector is greater than that required by a hydraulic air pump, provided that the air pump is driven by a steam turbine of moderate speed, or a motor.

LOSSES IN SURFACE CONDENSERS AND HOW THEY MAY BE PREVENTED

Losses that occur in surface condensers and materially affect the economy of the plant should have serious consideration before the installation is made. They are as follows: (1) Drop in vacuum or difference in pressure between the condensate; (2) difference in temperature of the entering steam and condensate, and (3) incomplete air removal.

The first loss is dependent upon the size of the shell and the shape, provided that the tube spacing is correctly designed—that is, has differential spacing decreasing the space between the tubes from top to bottom of the shell—and assuming that the condenser is of conventional design and not provided with steam lanes down through the nest of tubes to eliminate the drop through the condenser.

The second loss can be reduced to a minimum by careful design. Several large condensers have been built with rain plates inserted to give a substantially dry-tube condenser. However, the resultant loss due to the steam having to travel at right angles causes a loss equal to if not greater than the effect of producing cold condensate. The condensate temperature can be raised by the use of a primary heater in the top pass, but this construction is expensive both as to the cost of condenser and the additional piping required. In the conventional design of condenser of large size the condensate rains down through an appreciable space, and in coming in contact with the cold tubes its temperature is reduced 5 deg. to 10 deg. below that of the incoming steam. Obviously additional heat is required if the condensate is to be used for boiler-feed purposes.

It is extremely important that the tubes be properly spaced. If they are packed together to obtain as much surface as possible in a given size of shell, there is not much room for steam flow. This means that the drop in vacuum will be considerable between the air-pump connection and the steam entrance to the condenser.

Incomplete air removal is caused mainly by air leakage due to the system not being tight and also to the air pump having insufficient capacity. With an inefficient pump air will collect in the lower portion of the condenser, the direct effect being to lower the temperature and to reduce the heat head between the water in the tubes and the steam space. Consequently the heat transfer will be reduced and the condenser will be less efficient.

Either the hydraulic air pump or the steam ejector is capable of reducing the air pressure in the condenser to practically zero, so that the maximum temperature is maintained in the steam space nearest the offtake, meaning that the heat transfer will be increased. The maintenance of high temperatures in the lower part of the condenser also insures the condensate being at the maximum temperature, as it will assume the temperature of the vapor. It must be borne in mind that for every 10 deg. increase in the temperature of the condensate fed to the boilers approximately 1 per cent of fuel is saved.

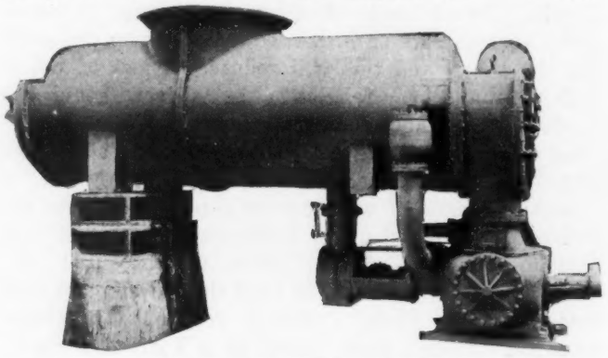


FIG. 2—UNIT-TYPE SURFACE CONDENSER BUILT IN SIZES UP TO 6000 SQ. FT.

With a reciprocating pump the temperature in the steam space in the bottom part of the condenser is about 15 deg. less than in the top part, owing to inefficient air removal. With the hydraulic air pump or steam ejector the temperature in the steam space is nearly the temperature of the steam at the entrance of the condenser, so that the temperature of the condensate is nearly that of the entering steam.

In a jet condenser the only effect of air being present

is to add its pressure to that of the vapor, thereby reducing the vacuum by a corresponding amount. That is, if, in a condenser carrying say 28 in. (71.12 cm.) of vacuum, air was allowed to collect in such amounts that its pressure was ½ in. (1.27 cm.), then the vacuum would be reduced to 27.5 in. (69.85 cm.). In a surface condenser, however, the collection of air to the extent of

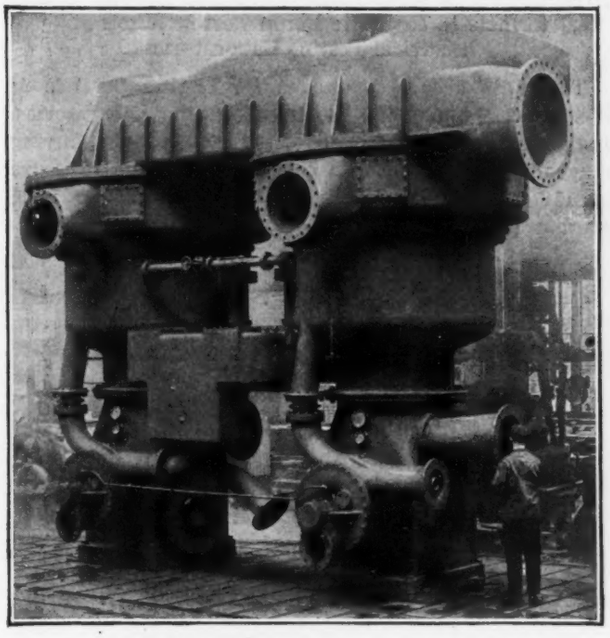


FIG. 3—TWIN-JET CONDENSER CAPABLE OF HANDLING 18,000,000 LB. OF WATER PER HOUR

its exerting a pressure of ½ in. (1.27 cm.) would make the vacuum much worse, as the effect would be relatively threefold. It would tend to diminish the vacuum to the same extent as in a jet condenser. The air present would insulate or blanket the tubes so that the heat transfer from the steam space to the water space would be seriously interfered with. The presence of air would also lower the temperature in certain zones of the steam space in the condenser, so that there would be less "heat head" to create a transfer of heat.

From the foregoing it will be seen that to get the best results from a surface condenser it is necessary to have air-removal apparatus that can maintain the air pressure in the shell at a negligible value.

CHARACTERISTICS OF AN IDEAL CONDENSER

In theory an ideal condenser should resemble a cone in shape, so that the velocity of the entering steam would be maintained constant to the point of air offtake. Such a condenser would not be practicable to build, however.

In the condenser shown at *B* (Fig. 1) the feature of constant steam velocity is obtained. Steam enters the tube nest substantially around the entire periphery of the shell, and the area of the steam space decreases as condensation takes place. The drop in vacuum from the top of the condenser to the air offtake is negligible, because the path of the steam is so short.

In all cases the condensate temperature is equal to the incoming steam temperature, and test results indicate that it is even 2 deg. to 5 deg. higher. The reason for this is that the area of the steam space at the bottom is slightly contracted, so that there will be an increase in velocity, and obviously an increase in pressure, due to compression. This will cause an increase in temperature, and the raining of the condensate through this steam would mean that the condensate would assume the increased temperature. The air is taken off at the center of the shell, the coldest part of the condenser.

With regard to heat transfer, the statement has been made that certain manufacturers are more conservative than others. This is no doubt due to the type of air-removal apparatus used in conjunction with the condenser. With efficient air-removing apparatus it is possible to establish artifically a greater heat head within the condenser, or, in other words, it is possible with efficient apparatus to use a smaller condenser to do substantially the same work as a larger condenser with inefficient air removal.

The unit-type surface condenser shown in Fig. 2 is designed for power plants of relatively small capacity and is built up to sizes having 6000 sq. ft. (592 sq. m.) of surface. The auxiliary equipment of pumps occupies little additional space as it is set directly under the condenser. The air pump receives its water supply from the main circulating system, regulation by a hand-operated valve giving the proper working suction for the pump. The shell and pumps are supported on beams or concrete, the foot farthest away from the pump being left free to move in the horizontal plane to allow for expansion due to temperature changes.

PROGRESS IN JET CONDENSER DESIGN

In low-level jet condensers the progress made in the last few years has been remarkable. Improvements in design with specific reference to spray nozzles and removal of air have decreased the terminal temperature difference between steam and discharge water from 10 deg. to 5 deg., assuming 28 in. vacuum and 70 deg. water. Formerly it was common practice to eliminate the use of jet condensers if the turbine unit was of appreciable size, say 20,000 kw. and up; but there are good reasons why in particular cases a jet condenser should be used. In the last three years jet condensers have been furnished for use in connection with 15,000-kw. to 45,000-kw. turbines, and they are operating successfully. The largest jet condenser installation to date is that installed in the power plant of the Narragansett Electric Lighting Company, Providence, R. I. It is a twin jet condenser circulating 18,000,000 lb. (8,160,000 kg.) of water per hour and serving a 45,000-kw. cross-compound turbine. It consists of two single-jet condensers interconnected by a steam equalizer at the top with the usual atmospheric relief connection at the end. There is also a connection to equalize the air pressure in the

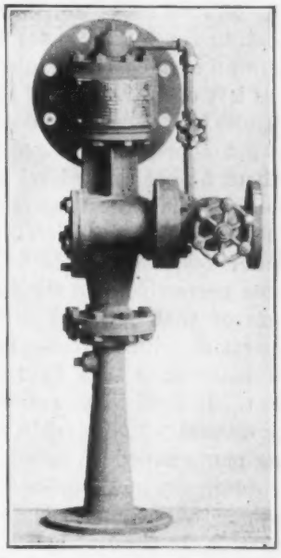


FIG. 4—STEAM-AIR EJECTORS FOR EVACUATING AIR FROM CONDENSERS

condenser and effectively to remove the air in case either pump for any reason should have to be operated at reduced capacity. A water-equalizing connection is also provided to make each removal pump handle its share of water and to maintain the same submergence over each pump.

Owing to the condensers being equalized in every respect, the unit is flexible. If for any reason one pump is out of operation, the condensers can be operated as single units. This arrangement also provides for economical operation, since in winter when cold water is available it is only necessary to operate one side of the condenser. If either of the pumps is in need of repairs, one set of pumps can be removed bodily and a blank flange inserted. One pump will then handle the load.

The field for steam ejectors as air evacuators is growing larger, since they are relatively simple compared with the high-vacuum air pump and require less attention. They have no moving parts, and the steam strainers and nozzles are the only part needing replacement. If a 28-in. vacuum or less is desired, the steam consumption of the ejector is slightly less than that of the hydraulic air pump. However, if 28.5 or 29 in. of vacuum is desired, the capacity of the air ejector must necessarily be greater and the steam consumption is nearly doubled, while the same hydraulic air pump can be used with the same steam consumption as for 28 in. of vacuum. From the standpoint of steam consumption only, the dividing line is 28 in. of vacuum.

Regarding the relative longevity of steel and Muntz metal tubes, the author believes that steel tubes would last as long as bronze tubes if proper precautions were taken to eliminate the action of the water. This is a question for the chemist to solve, however. Tin coating of steel tubes would be more beneficial than similar coating for Muntz metal tubes. The problem is to obtain an even coating, since if spots of the original metal are left open they would be subject to corrosion. From results that have been obtained the life of coated tubes is not appreciably longer than that of uncoated tubes. About 5½ per cent nickel would be required in the steel tubes. Since the time element would be an important factor in heat transfer through steel tubes the cooling water velocities should be relatively low. With a steel tube perfectly clean the heat transfer might be 85 per cent of that obtained with Muntz steel, but in actual operation with the tubes coated the heat transfer would probably drop to a figure ranging from 40 to 60 per cent. If steel tubes are used, it is obvious that it will be necessary to eliminate brass tube plates and circulating pump impellers, using steel or cast iron instead.

Admiralty metal tubes with zinc plates are better than copper tubes, in the opinion of the author. The proper location for the zinc is on the inner surface of the handhole covers. About 1 sq. ft. (0.092 sq. m.) of zinc plate should be used per 1000 sq. ft. (92 sq. m.) of condensing surface.

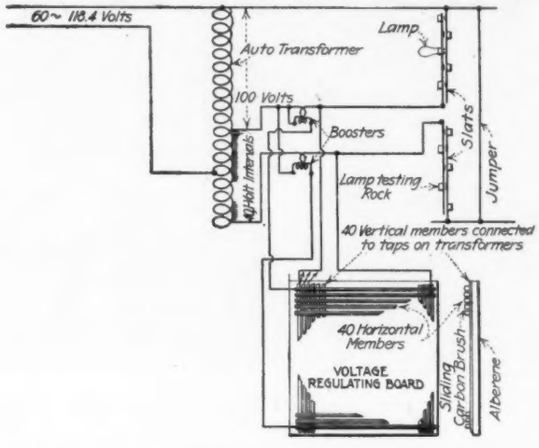
Rather than go into the high costs involved in high pressures, efforts should be made first to use to full advantage the vacua that are now available from the modern condenser. Designers need fuller information than they get from the average plant. Average yearly conditions are seldom taken and usually too small a condenser is installed for the maximum work expected.

The foregoing discussion formed part of the program at a joint meeting of the Western Society of Engineers and the Chicago Sections of the A. I. E. E. and A. S. M. E.

MEANS OF MAINTAINING ACCURATE TEST VOLTAGE

Arrangement of Auto-Transformer and Booster Transformers to Regulate Lamp Test Voltages at Electrical Testing Laboratories

To obtain accurate voltages for testing the life of incandescent lamps, the Electrical Testing Laboratories, Inc., is using the system indicated in the accompanying diagram. The accurately controlled machine pressure of 118.4 volts is fed into an auto transformer with 40 taps intended to give one-volt steps from 100 volts



ARRANGEMENT FOR OBTAINING ACCURATE LAMP TEST VOLTAGE

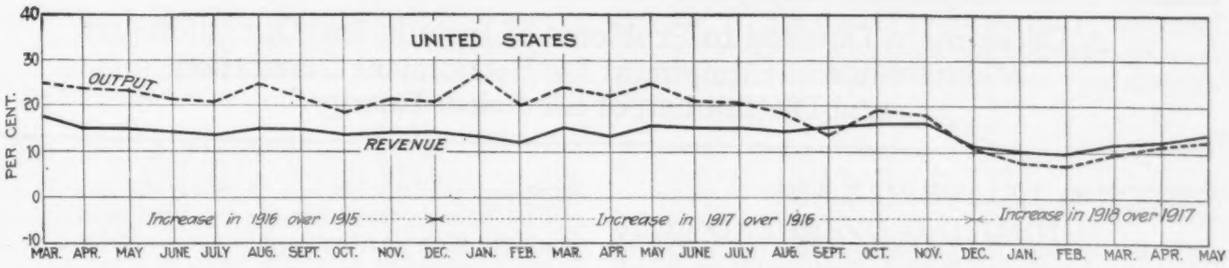
to 140 volts. These steps are not exactly one volt apart, and it is desirable that the life-test racks should be supplied with voltages of integral values. Moreover, the regulation of the various taps is not the same, some being far more sensitive to changes in load on the transformer than others. Therefore, into each line is introduced a small transformer having its secondary winding in series with the life-test line and the primary winding connected to a switchboard. To the latter are also brought the forty voltages.

The switchboard has vertical bars carrying the voltages from 0 to 40 and horizontal bars connecting with the boosting transformers. By manipulating carbon brushes on the horizontal members of the board the small transformers may be used for adding to or subtracting from the line voltage by any amount from zero to a maximum of something less than two volts, depending upon the voltage impressed on the primary winding. Inasmuch as there are 40 voltage steps covering a range of less than two volts on the secondary side, the adjustment of the line voltage can be carried out to a very high degree of precision.

By this means the various life-test lines are maintained at all times at the exact values required, irrespective of load. They are checked each day against the fundamental 118.4 volts, using an accurate two-element electrodynamometer as a differential voltmeter.

This information was contributed by Dr. Clayton H. Sharp, technical director of the Electrical Testing Laboratories.

Central Station May Operations



THE MAY GAIN IN BOTH REVENUE AND OUTPUT IS THE LARGEST SINCE NOVEMBER, 1917

MAY returns of the central stations follow the same general course as in the earlier months of the year; that is to say, there is a highly favorable rate of increase as compared with the corresponding month of the previous year. It is on the advancing scale which has brought greater improvement, as compared with 1917, month by month since Jan. 1. The May record indicates for 51 per cent of the industry a gain of 14.2 per cent in industry and of 12.6 per cent in output over May, 1917. On the basis of these figures the ELECTRICAL WORLD estimate for May for the whole industry is: Revenue, $36,320,000; output, 1,991,182,000 kw.-hr.

The May gain in both revenue and output is the largest shown this year and in fact since November. Undoubtedly the totals are affected by daylight saving and by the general movement for economy in fuel and lighting, but this influence is apparently more than offset by the great and continually enlarging demand for power for war industries and by the improvement in rates. Power consumption so largely dominates the business of the central stations that it is significant of the national activities in war that the industry looks upon an increase of 14 per cent over May, 1917, on top of a gain of 25 per cent in May, 1917, over May, 1916.

It is to be noted that the rate of revenue increase continues to be larger than the rate of output increase. This is in marked contrast to the tendency in most of last year, when the rates of increase in revenue during nine months ranged from 3.6 per cent to 12.3 per cent less than the rates of increase shown in kilowatt-hour output. Thus in October, 1917, revenue increased 15.4 per cent and output 19 per cent, while in January, 1917, revenue increased 14.4 per cent and output 26.7 per cent.

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE MONTHS

	Percentage of Industry Represented	Revenue from the Sale of Energy			Kw.-Hr. Output		
		1917	1916	Per Cent Increase	1917	1916	Per Cent Increase
June	63	$23,279,000	$20,168,000	15.6	1,407,860,000	1,165,629,000	20.8
July	63	22,768,000	19,680,000	15.7	1,397,482,000	1,159,410,000	20.5
Aug.	63	22,718,000	19,972,000	13.8	1,451,928,000	1,223,373,000	18.7
Sept.	63	23,861,000	20,896,000	14.3	1,376,370,000	1,219,117,000	13.0
Oct.	62	25,748,000	22,334,000	15.4	1,522,149,000	1,279,140,000	19.0
Nov.	62	26,665,000	23,183,000	17.0	1,485,370,000	1,292,113,000	15.1
Dec.	58	28,144,000	25,026,000	12.4	1,517,001,000	1,362,299,000	11.3
		1918	1917		1918	1917	
Jan.	62	27,035,000	24,977,000	8.2	1,508,353,000	1,422,121,000	6.1
Feb.	60	24,690,000	22,307,000	10.6	1,254,217,000	1,168,288,000	7.4
Mar.	60	25,396,000	22,702,000	12.3	1,418,222,000	1,294,561,000	9.5
Apr.	60	25,864,000	22,966,000	12.6	1,450,221,000	1,297,843,000	11.7
May	51	18,523,000	16,213,000	14.2	1,015,503,000	901,873,000	12.6

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	Percentage of Industry Represented	New England States			Percentage of Industry Represented	Atlantic States			Percentage of Industry Represented	Central States			Percentage of Industry Represented	Pacific and Mountain States		
			1917	1916	Per Cent Increase		1917	1916	Per Cent Increase		1917	1916	Per Cent Increase		1917	1916	Per Cent Increase
REVENUE	June	64	$2,641,000	$2,290,000	15.4	65	$9,281,000	$8,017,000	15.7	53	$6,718,000	$5,563,000	20.9	86	$4,480,000	$4,174,000	7.4
	July	64	2,634,000	2,205,000	19.4	65	8,919,000	7,687,000	16.1	53	6,690,000	5,643,000	18.6	86	4,482,000	4,110,000	9.2
	August	64	2,352,000	2,025,000	16.2	65	9,021,000	7,881,000	14.5	53	6,910,000	5,718,000	20.9	87	4,819,000	4,270,000	21.9
	Sept.	64	2,811,000	2,362,000	19.0	64	9,139,000	7,963,000	14.7	53	7,232,000	6,177,000	17.1	87	4,636,000	4,355,000	6.4
	Oct.	64	3,057,000	2,530,000	20.7	66	10,683,000	9,173,000	16.5	52	7,422,000	6,304,000	17.8	85	4,586,000	4,327,000	6.1
	Nov.	64	3,391,000	2,834,000	19.7	65	10,159,000	8,873,000	14.5	52	8,454,000	7,063,000	19.7	84	4,661,000	4,410,000	5.9
	Dec.	64	3,483,000	2,999,000	16.1	58	10,834,000	9,949,000	8.8	48	8,935,000	7,464,000	19.7	82	4,892,000	4,614,000	0.6
			1918	1917			1918	1917			1918	1917			1918	1917	
	Jan.	63	3,393,000	2,990,000	13.8	64	9,677,000	9,517,000	1.6	53	8,862,000	7,639,000	16.8	86	5,113,000	4,831,000	5.8
	Feb.	62	2,995,000	2,272,000	8.0	57	9,473,000	8,658,000	8.6	53	7,779,000	6,746,000	15.3	84	4,445,000	4,131,000	9.5
	March	62	2,985,000	2,724,000	9.2	59	9,904,000	8,922,000	11.0	53	7,947,000	6,735,000	18.0	84	4,560,000	4,321,000	5.5
	April	62	2,990,000	2,578,000	12.1	59	10,054,000	8,946,000	12.4	53	8,431,000	7,103,000	18.7	84	4,489,000	4,339,000	3.5
	May	61	2,777,000	2,499,000	11.1	57	8,439,000	7,389,000	14.2	36	4,518,000	3,829,000	18.0	72	2,789,000	2,496,000	11.7
			1917	1916			1917	1916			1917	1916			1917	1916	
KW.-HR. OUTPUT	June	64	106,817,000	87,345,000	22.4	65	496,784,000	392,905,000	26.5	53	393,770,000	318,316,000	23.6	86	399,622,000	358,727,000	11.2
	July	64	109,399,000	83,451,000	31.4	65	494,965,000	396,538,000	24.8	53	379,087,000	311,931,000	21.5	86	412,635,000	366,237,000	12.7
	August	64	105,848,000	85,113,000	24.5	65	514,254,000	420,806,000	22.3	53	415,966,000	333,549,000	24.7	87	413,462,000	381,353,000	8.3
	Sept.	64	114,339,000	92,319,000	24.0	64	482,112,000	405,070,000	19.0	53	399,480,000	345,953,000	15.5	87	379,221,000	374,685,000	1.4
	Oct.	64	121,666,000	94,853,000	28.5	66	589,242,000	472,619,000	24.5	52	417,018,000	351,713,000	17.0	85	394,223,000	359,955,000	9.6
	Nov.	64	130,311,000	108,561,000	20.0	65	532,301,000	445,537,000	19.6	52	443,374,000	384,480,000	15.2	84	379,384,000	357,535,000	6.1
	Dec.	64	135,703,000	111,342,000	21.8	58	548,316,000	486,368,000	12.7	48	437,264,000	367,534,000	12.8	82	395,518,000	377,058,000	4.8
			1918	1917			1918	1917			1918	1917			1918	1917	
	Jan.	63	125,212,000	111,339,000	12.4	64	477,200,000	466,158,000	2.3	53	486,291,000	453,009,000	7.3	86	419,651,000	391,624,000	7.3
	Feb.	62	110,454,000	102,562,000	7.7	57	438,721,000	403,122,000	8.3	53	358,276,000	342,257,000	4.5	84	346,766,000	320,025,000	8.4
	March	62	121,518,000	111,576,000	8.9	59	501,320,000	452,250,000	10.8	53	398,166,000	356,860,000	11.5	84	397,218,000	373,875,000	6.2
	April	62	117,416,000	101,888,000	15.2	59	497,460,000	431,786,000	15.2	53	437,054,000	392,304,000	11.4	84	399,126,000	372,465,000	7.1
	May	61	119,929,000	103,456,000	15.9	57	453,467,000	401,819,000	12.8	36	210,860,000	194,171,000	8.6	72	231,247,000	202,427,000	14.2

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

SPEEDING DELIVERIES AND MINIMIZING OVERHEAD COST

Companies Report Idle Stock to Clearing House, Which Then Issues List of Stock for Immediate Delivery

Realizing that it is difficult if not impossible to get new equipment under present conditions and desiring to keep down the investment in idle stock, some companies with electric service plants in various parts of the country have established clearing houses for idle stock regardless of whether it is new or used. Each plant is required to report its idle stock on hand periodically, this information being published in booklet form by the holding company and distributed among its plants. When any plant is in need of equipment included in this list it can communicate with the plant having the apparatus or material or with the holding company. Thus equipment can be obtained in a very short time compared with most manufacturers' deliveries nowadays. Furthermore, very much less reserve stock has to be carried.

SELECTION OF FUSES FOR MOTOR-DRIVEN MACHINES

Fuses Rated to Withstand Starting Current of Squirrel-Cage Motors Sometimes Fail to Operate on Overloads and Do Not Protect Machine

Although fuses are quite commonly employed in motor-circuits their use is liable to be attended with uncertain results when starting and operating induction motors, the starting current of which may greatly exceed the full-load current, unless they are properly applied. The accompanying table brings out a few of the difficulties which may be experienced in the attempt to select a fuse with a rating adapted both to starting conditions and to ordinary running conditions.

From this table it is apparent that in many cases of starting induction motors a fuse selected to protect from overload is very likely to blow at starting and a fuse capable of carrying the starting current will not protect for ordinary conditions of operation. Hence in those cases where the motor is started and operated through the same fuses it is necessary to take into account the starting current, the time interval over which the high starting current flows and the time lag of the fuse itself. Such tests show that these factors vary over quite wide limits for different fuse types and to some extent for the same fuse at different periods.

STARTING CURRENT OF THREE-PHASE, 60-CYCLE SQUIRREL-CAGE INDUCTION MOTORS

Manufacturer's Indication	—Starting with Light Load— Per Cent of Full-Load Current	Time Involved	Starting with Full Load Per Cent. of Full-Load Current	Time Involved, Sec.
1	600	Instantaneous	600	5
2	500 to 600	Instantaneous	500 to 600	5 to 8
3	600	Instantaneous	600	6
4	450 to 500	Instantaneous	450 to 500	4 to 5
5	600	One-half second	600	30
6	500 to 600	Instantaneous	500 to 600	5
7	600	Instantaneous	600	6
8	500	Instantaneous	500 to 600	6 to 8

AUTOMATIC CIRCUIT BREAKERS SAVE LABOR IN COAL MINES

Installation Both Above Ground and Underground Is Being Practiced to Keep Coal Production at Maximum Figure

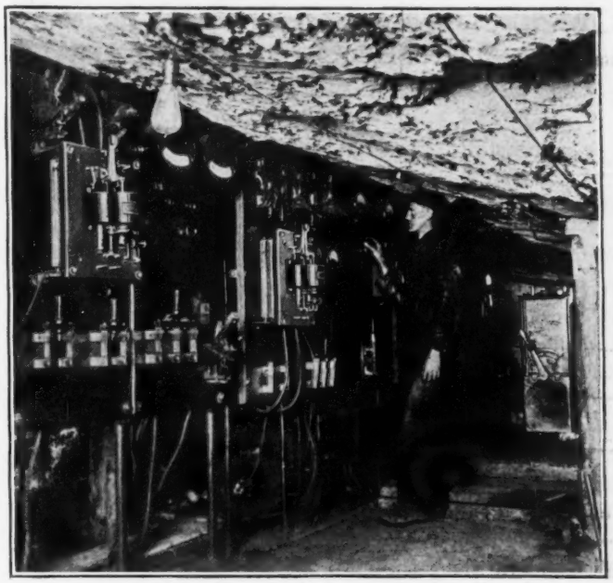
Coal mines in the Central West which use electric power for operating coal-cutting machines and haulage systems are finding economical applications for circuit breakers of the automatic reclosing type. At ordinary mines, with a power house or substation above ground feeding 250-volt direct current to different places underground, a single large breaker is usually installed at the station and a breaker for each branch circuit is installed at the undergound boards.

To illustrate the operation of such a system it may be assumed that a 1200-amp. automatic reclosing circuit breaker is installed in the substation and two 600-amp. and one 400-amp. reclosing circuit breakers below ground. Each of the latter is connected with a branch circuit running far out into the workings. If a short circuit or heavy overload should occur on one of the 600-amp. lines on account of a "cave-in" tearing down a trolley wire or from some similar cause, then the 600-amp. breaker would open the circuit and keep it open until the trouble was cleared, when it would automatically reclose. This would not interrupt the men working in parts of the mine served by the other circuits. If the case is not serious, the miners could clear the ground, after making sure that the breaker would stay open, by grounding the circuit with a chain or crowbar placed between the trolley and the rail. After the chain or crowbar was removed the breaker would close of its own accord. If the breaker were of the manually operated type, work would have to be held up while some one traversed the entire distance from the end of the workings to the switchboard to close the switch.

A low-resistance shunt path around the reclosing coil of the automatic reclosing breaker to ground prevents it from alternately opening and closing at high speed under short-circuit conditions. It will remain either open or closed as conditions on the circuits justify. The practice of installing an automatic breaker at the substation is usually followed because the attendant is not always right at hand and this unit is required to protect the station apparatus. The rating of this breaker is usually less than the sums of the ratings of those on branch circuits on account of diversity factor.

In some mines the installation of this apparatus is

effecting substantial savings in money and in labor. One mine which formerly paid a man $5 a day to sit at its switchboard under ground and see that a 1200-amp. breaker stayed closed has now replaced this arrangement with an automatic breaker at a total cost of $600. Thus in less than 120 days the mine had its money back, and during that time and ever since it had the productive



SWITCHBOARD INSTALLATION DOWN IN MINE, EQUIPPED WITH RECLOSING CIRCUIT BREAKERS

labor of another miner. The usual installations are smaller than the one mentioned, requiring breakers of 100 amp. to 400 amp. in rating which can be installed for $135 to $150.

CONVENIENT MARKER FOR SERIES LAMP SOCKETS

Its Use Has Been Found Necessary by One Company Where Lamps Are Operated on Low-Voltage Circuits

BY R. A. PAINE, JR.
Edison Electric Illuminating Company of Brooklyn

When it is necessary to supply lighting on a bridge or on a side street with heavy trees, or where a small number of lamps are needed on underground service and there is an existing series lighting circuit in the vicinity, the most economical method of supplying service is generally by the use of a one-to-one current transformer the primary of which is connected to the existing high-voltage series circuit and the secondary to the circuit to supply the new lamps. Since the secondary voltage of these current transformers is low, it is necessary to use a disk between the clips of the series sockets of the lamp containers supplied from the transformers that will puncture at a lower voltage than the standard disk used with the series sockets on the high-voltage circuits.

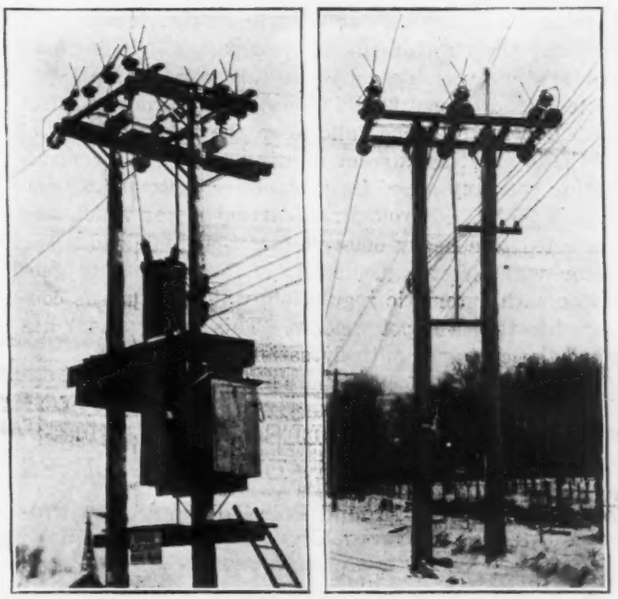
This arrangement makes necessary the use of two types of disk, and it has been found advisable to mark the series sockets on the low-voltage series circuit in some manner that will indicate that a low-voltage disk is to be used with them. A large public service corporation has found that a convenient way to mark these sockets is to use a piece of varnished cambric cut in the shape of a semicircle of ¾-in. (2.2-cm.) radius in which a slit is cut to allow the marker to be slipped over one of the clips of the socket to a point where it rests on the rubber washer just above the porcelain of the socket.

STURDY SUBSTATION FOR SERVING SMALL TOWNS

Switching Apparatus Mounted on Double-Pole Construction and Substation Equipment Arranged with Double Platform

In order to serve small towns from substations with a minimum first cost and at the same time be assured that the apparatus is accessible for repairing, the Northern Iowa Gas & Electric Company has constructed the sections shown in the illustrations. The substation (Fig. 1) consists of a 20-kva. Moloney transformer and Delta-Star switching equipment mounted on a two-pole, two-story platform structure. The transformer is mounted on the upper platform, and the low-tension switching equipment is mounted slightly above the lower platform so that it may be reached easily. The box in the foreground contains the main switch, the fuse for 220-110 volt three-wire distribution system, a watt-hour meter and a time switch for the street-lighting circuit. A telephone station with protective apparatus is contained in the box directly under the transformer.

The switching station (Fig. 2) consists of a three-pole-type DM 33,000-volt Delta-Star disconnecting



FIGS. 1 AND 2—SIMPLE SUBSTATION AND SWITCHING STATION FOR SERVING SMALL TOWN

switch mounted on a wooden frame composed of the double cross-arms on each pole and longer arms running across their ends.

As may be seen from the pictures, the poles are set with the gains parallel to the lines. The dead-end insulators at which the conductors terminate are also attached to this frame.

ECONOMICAL PRACTICES WITH JEWELS FOR METERS

Minneapolis Company Uses Diamond Jewels but Changes to Sapphire When Meters Are Taken Out of Service

Realizing that diamond meter jewels must be kept in service to justify their high first cost, the Minneapolis General Electric Company places these jewels in each instrument when the installation test is made but replaces them with sapphire when the service is disconnected. Thus money invested in expensive jewels is not allowed to become idle when meters are placed in stock. The diamond jewels are considered more economical where they can be kept in service because they will withstand 40,000,000 revolutions without showing appreciable wear, whereas sapphire will withstand only 700,000 revolutions before wearing out.

The extent to which the jewels are lubricated has also been found to affect their wearing qualities and the friction considerably. According to a test with jewels operating under three conditions—flooded with oil, with only a trace of oil, and dry—the jewel flooded with oil gives the best results and the dry jewel gives the worst.

AVOIDING DISTURBANCES CAUSED BY SPOT WELDERS

Topeka Company Urges Customers to Use Direct-Current Motor-Generator in Order to Keep Fluctuations Off Lighting Circuit

When the Perfection Metal Products Company, Topeka, Kan., applied for electric service for its spot welders the central-station company's single-phase primary line was inadequate to take care of the intermittent load caused by this service. In order to effect conservation on copper and keep the undesirable load off the alternating-current lighting circuit, the central-station company asked its prospective customer to purchase a 95-hp., 600-volt direct-current motor which was connected to a heavy 600-volt direct-current lead. The motor was direct-connected to a 75-kw. welding generator with automatic regulation, which in turn is connected to the two spot welders. This arrangement has given the customer entirely satisfactory service.

RAISING STEEL POLES BETWEEN EXISTING LINES

Wooden Box Built Around Pole Top Used as a Protection to Prevent Grounding of Leads During Construction

One of the difficulties encountered in raising steel poles between existing lines is that the steel pole frequently comes in contact with one of the conductors and not only impairs service but is likely to injure one or more of the erecting crew. To obviate this difficulty, the Fort Smith (Ark.) Light & Traction Company built wooden boxes around the tops of steel poles which it was erecting to take the place of woolen poles which supported light and power distribution lines and trolley span wires on the main streets of the city.

The boxes were made by using 1-in. by 8-in. by 12-ft. (2.5-cm. by 20.3-cm. by 3.6-m.) soft pine boards as sides and 1-in. by 4-in. by 12-in. (2.5-cm. by 10.1-cm. by 30-cm.) pine boards for ends of the box. These were nailed together so that the pole taper held them from sliding down. After erection and adjusting clearances the boards were removed.

SIMPLE TESTING MEANS FOR SHORT CIRCUIT ON MAIN

Fuse Inserted in Transformer Secondary and Momentary Connections Made with Split-Type Current Transformer at Different Points Along Main

BY LEON C. WHITE
Superintendent of Operation Twin State Gas & Electric Company, Brattleboro, Vt.

Where a large number of services are taken off from one transformer it is sometimes a long job to locate a "short" which has developed in the entrance pipe or underground service. The following method may be used to locate the service which is causing the trouble:

Open the secondary at the transformer and place a split-type current transformer connected to its ammeter on the secondary main leading away from the main transformer. Close the secondary through a piece of fuse wire small enough to prevent primary fuses from blowing and note if the ammeter indicates any current. If so, follow along the main at intervals and make tests until no indication is shown upon closing the secondary. The services just passed can then be tested. The one which causes an ammeter depletion will be found to be the one which is in trouble.

In closing the secondary it will only be necessary to touch the ends quickly as this will be sufficient to "kick" the ammeter and save the fuse. If the transformer is located in the middle of the secondary main, a test on each side of transformer will determine which way trouble lies.

CEMENT COATING SAID NOT TO HARM INSULATORS

Trouble on Transmission Line Operating at 33,000 Volts Near Cement Mill Fails to Develop, Says Central West Company

When a 33,000-volt, three-phase transmission line was built about three years ago to serve a cement mill in the Central West little thought was given to the fact that the fine cement dust flying through the air would soon coat the insulator on the side nearest the mill. When the engineers of the central-station company supplying the energy noticed this coating becoming more and more dense, some apprehension prevailed as to what the possible effect would be on the insulating characteristics of the insulators. Up to the present time, however, no trouble has developed, and none is expected since the insulators are now coated to a considerable thickness with a dull gray coat of cement on one side. The engineer of this power company is of the opinion that, under similar circumstances, guarding against the deposit of cement on 33,000-volt insulators is not necessary. This may not be so where conducting particles are deposited with the cement or where the insulators are subjected to salt air or acid vapors.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

TOPEKA CENTRAL STATION CO-OPERATES WITH BANK

Time Payment Sales on House Wiring and on Appliances Are Still Handled on a Large Scale by Turning Over Collections to a Bank

In the last three and one-half years the Topeka (Kan.) Edison Company has done $110,000 worth of wiring and appliance business, practically all of which was on the time-payment basis. This includes the wiring of 2500 homes. After $90,000 worth of this business had been done, the company carrying all finances itself, a plan of co-operation with the Morris Plan Bank was arranged. Between Sept. 15, 1917, and April 17, 1918, the company turned over $23,222 worth of business to the bank, of which amount a bank had already collected $19,676. The company's proposition to the bank was that it would stand back of the paper and would pay the bank 4 per cent. As most of the paper runs only six months, this makes the earnings of the bank about 8 per cent on an annual basis.

A regular form of contract is used which was selected because it can be recorded, in order to give the company legal recourse in case subsequent payments are not made by the purchaser. On the reverse side of this agreement is found the following: "For a valuable consideration, receipt of which is hereby acknowledged, we hereby sell and assign the installment contract specified on the reverse side to the Topeka Morris Plan Company, Topeka, Kan. The Topeka Edison Company hereby agrees to pay the Topeka Morris Plan Company any amount that may remain unpaid on this contract." This is merely an assignment of the contract to the Morris Plan Bank, together with an agreement to make good any unpaid balances.

ADVICE ON HOW TO USE THE NEW-BUSINESS DEPARTMENT

Collection of Data on Essential Character of Company's Power Customers Is Job at Which Salesmen Are Effective

What to do with the remaining members of the central-station sales department is a problem confronting some managers. With virtually no energy to sell, the routine sales work in a number of companies is at low ebb. Nevertheless, it does not appear desirable to part with the older trained men of the sales department, because the time will surely come when their expert knowledge will be needed. Meanwhile they must find something profitable to do. Transference to another department is favored by some executives as a means of broadening the salesmen's point of view. Especially good results have been secured in some cases by placing former commercial managers in charge of credits, collections and billing. In still other places the men have been assigned to special work.

One special job which an Indiana manager has assigned to his commercial department is that of collecting data on the operations of power users. These data consist of records of energy used, amount and character of product turned out by customers, and calculations to show how much of the energy used is being devoted to the manufacture of essential products.

The object of getting this data is twofold. First, it gives the manager facts and figures on which to base his "case" when priority on coal or material is sought. Second, it will afford an excellent guide for the manager if in the coming winter it is found necessary temporarily to curtail service because of coal shortage or other emergencies.

THE OPERATIONS OF LAND AND TAX DEPARTMENT

Statement of Purpose for Which This Unusual Bureau Was Formed and Something About Its Methods of Saving Money

The Northern States Power Company, with headquarters at Minneapolis, Minn., has a "land and tax department" with subsidiary branches in eight cities,

Sheet No._____

Abstract of Instruments by which . . . . . —

its predecessors or representatives obtained title to the real estate now owned by said Company or by which defects in the title to such real estate were remedied.

Form of Instrument, Date,

Grantor,

Grantee,

Expressed Consideration, Actual Cost to above named Company,

Covers real estate in the County of in the State of

described as follows, to-wit:

Remarks,

Filed for Record in the office of the Register of Deeds in and for said County on

and recorded in Book of Deeds at pages

Company's Instrument No. Posted to List of Company's Real Estate

Original Instrument is in the office of

I hereby certify that the foregoing is a true and correct abstract of the instrument therein described.

Dated at 19

FIG. 1—DUPLICATE DEED FORM USED FOR CONTINUAL REFERENCE

its duties being to purchase land for transmission lines, water-power developments steam-station and substation sites, and to study tax questions with an idea of keeping

the taxes paid by the company as nearly as possible within an amount equal to that asked of other taxpayers. Since it was formed in 1906 this department has purchased 40,000 acres of land for water-power development alone. The taxes on real estate and personal property over which it has jurisdiction range from $240,000 to $300,000 per year. The department has saved this company considerable money and has well justified its establishment.

Whereas, The party of the second part, hereinafter named, ... successors or assigns, intend ... to cause to be constructed, maintained and operated a dam or dams across the Mississippi River, and other works for all or any of the following purposes, viz: To create or improve a water supply or waterpower for public or private use and for other purposes, and to develop such water power for manufacturing, lighting and for other lawful purposes, public or private or both, including among other purposes, the development, generation and disposition of electricity and electrical power

Now Therefore, This Indenture, made this ..... day of ..... A. D 190 ..., between ..... and ..... his wife, of the County of ..... and State of Minnesota, part ..... of the first part, and ..... party of the second part.

Witnesseth, That the said part ... of the first part, for and in consideration of ..... dollars to ... in hand paid by the party of the second part, the receipt of which is hereby acknowledged, do ... hereby grant, bargain, sell and convey unto the said party of the second part, ... successors and assigns, the perpetual, sole and exclusive right, privilege, authority and easement to overflow, inundate or otherwise use all or any part of the following described lands, lying and being in the County of ..... and State of Minnesota, viz.

in Section ....., Township ....., Range ....., according to the government survey thereof; and for the same consideration said first part ... do ... hereby grant, bargain, sell and convey unto the party of the second part, ... heirs, executors, administrators, successors and assigns forever, all of the right, title and interest of first ..... in and to the use and enjoyment of the Mississippi River and the waters thereof, and the land covered by the waters thereof, which the part ... of the first part ha ... by reason of being the owner or owners in fee or otherwise of the lands above described, or any of them.

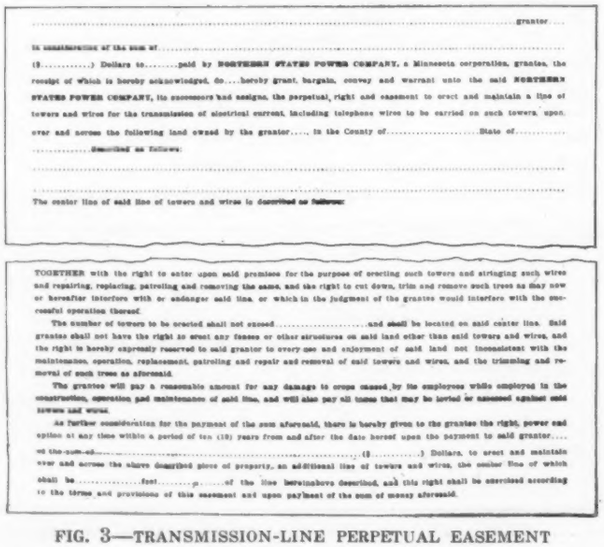
And the said part ... of the first part do ... hereby release, discharge and acquit the party of the second part, ... heirs, executors, administrators, successors and assigns from all and every claim of whatsoever nature or description which said first part ..., ... heirs, executors, administrators, successors or assigns now has, or may or shall hereafter have or claim to have against second party, ... successors or assigns for any and all damages of whatsoever name, character or description, which may be suffered or incurred by first part ..., or ..... successors in interest, by reason of overflowing or inundating or otherwise using the lands above described in connection with the construction, maintenance or operation by second party, ... successors or assigns, of any dam or dams or other works across or upon the Mississippi River, or by reason of the exercise of any right, privilege or easement by this indenture granted.

All of the provisions, covenants, agreements, conditions and limitations h ... in contained, shall extend to and be obligatory upon and inure to the benefit of the heirs, executors, administrators, successors, assigns and grantees of the respective parties hereto.

In Testimony Whereof, The said part ... of the first part ha ... hereunto set ..... hand ... and seal ... the day and year first above written.

FIG. 2—FLOWAGE DEED USED WHERE OUTRIGHT PURCHASE IS NOT DESIRED BY LAND OWNER

Some of the forms that have been developed for use by this department may be found of interest to other companies. One of these is a deed form. It was not thought advisable to have the original deed moved around from place to place and used as a source of constant information. The original deed is therefore filed with the company's legal department in Chicago, while this loose-leaf form, made out to give the same information that should be secured from the original deed, is preserved in the land and tax department for continual reference.



..... grantor ....

In consideration of the sum of .....

($.....) Dollars to ..... paid by **NORTHERN STATES POWER COMPANY**, a Minnesota corporation, grantee, the receipt of which is hereby acknowledged, do ... hereby grant, bargain, convey and warrant unto the said **NORTHERN STATES POWER COMPANY**, its successors and assigns, the perpetual, right and easement to erect and maintain a line of towers and wires for the transmission of electrical current, including telephone wires to be carried on such towers, upon, over and across the following land owned by the grantor ..., in the County of ..... State of ..... described as follows:

.....

.....

The center line of said line of towers and wires is described as follows:

.....

TOGETHER with the right to enter upon said premises for the purpose of erecting such towers and stringing such wires and repairing, replacing, patrolling and removing the same, and the right to cut down, trim and remove such trees as may now or hereafter interfere with or endanger said line, or which in the judgment of the grantee would interfere with the successful operation thereof.

The number of towers to be erected shall not exceed ..... and shall be located on said center line. Said grantee shall not have the right to erect any fences or other structures on said land other than said towers and wires, and the right is hereby expressly reserved to said grantor to every use and enjoyment of said land not inconsistent with the maintenance, operation, replacement, patrolling and repair and removal of said towers and wires, and the trimming and removal of such trees as aforesaid.

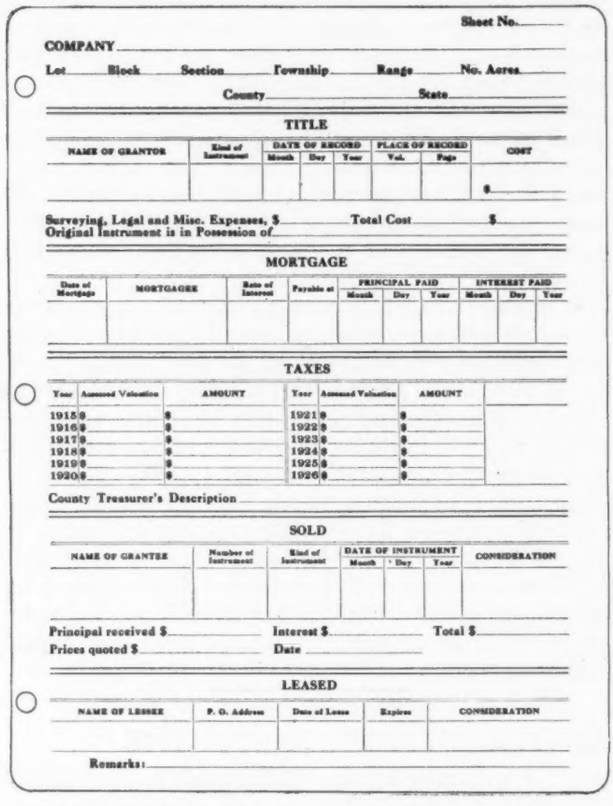
The grantee will pay a reasonable amount for any damage to crops caused by its employees while employed in the construction, operation and maintenance of said line, and will also pay all taxes that may be levied or assessed against said towers and wires.

As further consideration for the payment of the sum aforesaid, there is hereby given to the grantee the right, power and option at any time within a period of ten (10) years from and after the date hereof upon the payment to said grantor ... of the sum of ..... ($.....) Dollars, to erect and maintain over and across the above described piece of property, an additional line of towers and wires, the center line of which shall be ..... feet ..... of the line hereinabove described, and this right shall be exercised according to the terms and provisions of this easement and upon payment of the sum of money aforesaid.

FIG. 3—TRANSMISSION-LINE PERPETUAL EASEMENT

Another interesting form which the department has worked out is the flowage deed. A need for this document was felt largely because it is advantageous to be able to go to a land owner with more than one definite proposition. The plan under which this form was used was to go to the land owner with the proposition to buy the land outright or to buy the right to overflow the land at any time. This flowage deed gives the latter right. It has proved very useful in simplifying and expediting negotiations with owners of property that the company desires to acquire.

The perpetual easement which is shown in Fig. 3 has been worked up to cover all points that the land owner has been found prone to ask questions about when a transmission-line right of way is sought. It covers such questions as tree trimming, patrolling the line, damages to crops, and taxes.



Sheet No. .....

COMPANY .....

Lot ... Block ... Section ... Township ... Range ... No. Acres ...

County ... State ...

TITLE

NAME OF GRANTOR	Kind of Instrument	DATE OF RECORD Month	Day	Year	PLACE OF RECORD Vol.	Page	COST
							$

Surveying, Legal and Misc. Expenses, $ ... Total Cost ... $ ...
Original Instrument is in Possession of ...

MORTGAGE

Date of Mortgage	MORTGAGEE	Rate of Interest	Payable at	PRINCIPAL PAID Month	Day	Year	INTEREST PAID Month	Day	Year

TAXES

Year	Assessed Valuation	AMOUNT	Year	Assessed Valuation	AMOUNT
1915	$	$	1921	$	$
1916	$	$	1922	$	$
1917	$	$	1923	$	$
1918	$	$	1924	$	$
1919	$	$	1925	$	$
1920	$	$	1926	$	$

County Treasurer's Description .....

SOLD

NAME OF GRANTEE	Number of Instrument	Kind of Instrument	DATE OF INSTRUMENT Month	Day	Year	CONSIDERATION

Principal received $ ... Interest $ ... Total $ ...
Prices quoted $ ... Date ...

LEASED

NAME OF LESSEE	P. O. Address	Date of Lease	Expires	CONSIDERATION

Remarks: .....

FIG. 4—OFFICE RECORD ON HISTORY OF PROPERTY

A fourth form which the department has found of considerable value is an office record for data on each piece of property owned by the company. A separate sheet is used for each individual site. Each page contains data on location, price, title, mortgages, taxes and sales relating to that individual piece of property. The sheet is indeed a complete history of the piece of property, a feature of which is the record of the taxes. If the amount of taxes goes up out of proportion, it can be immediately discovered from this sheet, and steps can be at once taken to remedy the trouble if this is possible.

NEW SEASONAL RATE OF MAINE CENTRAL STATION

Summer Energy Billed at 15 Cents per Kilowatt-Hour with Opportunity for Year-Around Customers to Save Amount in Winter at 5-Cent Rate

An interesting seasonal rate has recently been placed in effect on the beach resort territory served by the York County Power Company of Biddeford, Me. The rate is designed to yield an increased revenue during the summer months, when the peak load in this territory occurs, and at the same time enables the off-season user and the year-around resident to obtain energy at a reasonable charge. The rate does not apply to the urban centers at Biddeford and Saco, or to the areas immediately adjacent, but affects users of energy in Scarboro, Old Orchard, Kennebunk, Kennebunkport, North Kennebunkport, Wells, York and that part of Biddeford and Saco east of lines running north and southwest from the Pool Road substation, for all lighting purposes, domestic heating apparatus and appliances, and motors of 1 hp. or less used in connection with a lighting installation.

Energy used in June, July, August and September is billed at the rate of 15 cents per kilowatt-hour for the first 200 kw.-hr. used per month, a rate of 10 cents per kilowatt-hour applying to all energy in excess of 200 kw.-hr. For energy used in other months than the above, the rate is 10 cents per kilowatt-hour, with the following exceptions: A customer may use in one or more of the months of November, December, January and February at 5 cents per kilowatt-hour an aggregate amount of energy up to but not in excess of the aggregate amount used by him at 15 cents per kilowatt-hour in any or all of the months of June, July, August and September.

This schedule was prepared in response to a recent decision of the Maine Public Utilities Commission reducing the seasonal rate from 20 to 15 cents during the four summer months. The rate of 10 cents is enjoyed by year-around customers only, and these receive credit at the rate of 5 cents per kilowatt-hour for all energy which they use during the summer months, as indicated. This arrangement places the higher rate on the peak-period service, which involves a greatly increased overhead charge to the company, and it applies the reduction to the year-around customers at a time when the load on the summer district, so to speak, is at its minimum. The rate carries a minimum charge of $12 per year. For any period less than one year the minimum charge is fixed at $2 for each of the four summer months plus $1 for each of the remaining months of the year. In no case, however, is the total minimum charge for a period less than one year allowed to exceed $12.

The foregoing rates are net, and under them the company installs one or more initial meters at its option, all other meters being installed at the request of the customer at a rental charge of 50 cents per month per meter. To avoid the necessity of reading meters on the first day of any month, so that the billing rate will apply to the previous month, the company specifies that a meter reading shall be considered as rated in the month in which the majority of days have elapsed at the date of the reading; for example, a reading July 10 would be billed at the June rate; a reading on Oct. 17 would be billed at the October rate, etc.

The new rates enable large users like summer hotels to obtain a substantial reduction upon using relatively large amounts of energy even in the peak-load period; while users at other times, whether permanent or temporary residents, get the benefit of lower rates. This is advantageous in the case of caretakers of large estates using energy outside the summer season and to other occupants of the separated territory.

VALUE OF CO-OPERATION TO NEW-BUSINESS DEPARTMENT

Employees Should Realize the Importance of Understanding How Utility Company Conducts Its Affairs So as to Help Make Public Good Will

There is no doubt that utility employees, in their contact with the public, can, by understanding better what the company stands for and how it conducts its business, help the company in many ways. One of these is in the matter of getting new business. The points in this connection which follow were brought out at a recent meeting of the Lincoln (Neb.) Gas & Electric Company by James Greenstone of the new-business department, in a paper entitled "Co-operation—Wherein It Will Assist in Increased Business":

Every business that amounts to anything has a very carefully thought-out and perfected organization. In fact, a modern business organization is usually a very intricate thing, not conceived at once in its entirety, but invented and developed a part at a time. No student of business can afford to pass up the study of organization, for a good organization is essential to success. Even if a person is to be but a spoke in a wheel, he should observe how it goes around and why.

Regardless of the trouble this company has had in the past, its popularity with the public in general is very encouraging and the business houses hold us in high regard. We are doing a good business, taking everything into consideration. But the point I wish to emphasize is that both our popularity and our volume of business must be increased, and the percentage of increase must be of good proportion for our future welfare.

The subject of co-operation, you will agree, is a big one. One could offer any number of suggestions as to how the various departments could assist the new-business department in securing additional business, but they would be of no consequence unless you could first be made to understand that it is essential for you to feel that you are an equal factor in a combined force seeking to attain a combined result.

You should know that we can supply for any purpose an appliance for either gas or electricity that can be made use of by any one, and that the appliance obtained through us will be of the best and at a more reasonable price than can be found elsewhere, because we are a part of one of the largest concerns of this nature in the country and are the largest buyers of this line of goods in this city.

You should know that we do not recommend an appliance from the standpoint of its ability to consume an unreasonable amount of our products, but that our recommendations are based on the ability of that appliance to give satisfaction, in order that the purchaser shall keep it in constant use and thereby add to output. In this lies the real profit for the company.

You should know that we maintain service departments for the benefit of our consumers so they may derive the maximum of satisfaction in the use of our products or the appliance they may purchase from us. And, knowing these things, you should not be backward in telling others about them.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Lamps and Lighting

Lighting Effect of New Interstate Bridge.—A description of the bridge across the Columbia River at Vancouver, Wash., giving details of the lighting system installed with illustrations—*Journal of Electricity, Power and Gas,* July 1, 1918.

Fundamentals of Illumination Design, Part III.—WARD HARRISON.—This part of the series includes a general discussion of the principles underlying the use of reflectors and inclosing glassware for illumination purposes and also gives typical applications of various well-known units. Four principal characteristics of glassware are considered, namely, absorption, reflection, refraction and diffusion. By the proper understanding of the application of these characteristics the light from almost any source may be controlled as desired. For reflecting purposes both polished metal and mirrored glass are available. Polished silver has very high efficiency, but it may be difficult to keep it clean, and although mirrored glass reflectors may be less efficient than polished metal reflectors, they are more permanent. By properly shaping the reflector light may be directed as desired. The use of parabolic reflectors for automobile headlights is a good example. With rough matte-surface reflectors (such as blotting paper) the shape is immaterial, since the illumination appears to be of the same intensity viewed from any direction. Care should be exercised, however, in use of deep bowls of this type, since a great deal of light may be lost by absorption when the rays are reflected back and forth within the bowl. The author points out the use of prismatic glassware for directing the light and states that the efficiency of this type of reflector is high on account of the low absorption. For the transmission of light from sources of high intrinsic brilliancy he suggests the use of clear glass which has been "flashed" to form an opalescent coating, on account the high efficiency of this inclosing globe.—*General Electric Review,* July, 1918.

Report on Automobile Headlamps.—The report of the 1916-17 committee on automobile headlamps covers the general requirement of vision, including road illumination, intensity distribution, direction and glare. It also includes the general topics "Optical Principles of Headlighting," "Practical Headlighting" and "Safety Limitations."—*Transactions I. E. S.,* July 20, 1918.

Generation, Transmission and Distribution

The Major Power Possibilities in California.—F. H. FOWLER.—In discussing the general power situation in the West the author points out that the sources of power, light and heat for California, Oregon, Washington, Nevada and Arizona for 1917 were: Coal and coke, 16 per cent.; fuel oil and natural gas, 64.5 per cent; hydroelectric power, 19.5 per cent. For California alone 84,000,000 bbl. of oil were used, of which 34,000,000 bbl. were for the railways, showing the possibilities of oil economy by electrification of the railways. Curves are presented showing the increasing use of electrical energy in California, from which it is estimated that the peak load in 1921 will be 700,000 kw. To meet this rapidly increasing demand there are three principal developments which offer the greatest possibilities. These are the Pit River project, from which a continuous minimum output of 130,000 kw. may be anticipated; the Feather River project, from which a minimum of 145,000 kw. is expected, and the Big Creek development, where 100,000 minimum kw. may be obtained. With these developments immediately in view the author feels that the California companies need not hesitate to start active campaigns for new business.—*Journal of Electricity, Power and Gas,* July 1, 1918.

Constructive Water-Power Policy.—JOHN A. BRITTON.—War conditions have greatly developed the industries of the Far West, but too much oil is now used for the generation of electricity. This energy should be derived from the water-power sites so abundant in that vicinity. The writer states that present laws are unfair, as capital is not attracted under existing conditions. He does not think that the attitude of the government in exercising absolute control over water powers is justified where the government owns but little land adjacent to the stream supplying energy. As an example, in connection with the Lake Spalding development, the goverment owns thirty-eight acres compared to 12,000 acres privately owned along the stream under development. Bills now before Congress provide for a freer use of power sites under national control. A strong plea is entered for the encouragement of those who would develop the water power of the West now going to waste.—*Journal Electricity, Power and Gas,* July 1, 1918.

Large Oil-Break Switches.—Design data are given for certain large oil-break switches to be used for heavy service as manufactured by the British Thomson-Houston Company of Rugby, England. There are two long breaks in each phase. The minimum break is 16 in. (40.6 cm.), giving 32 in. (81.3 cm.) per phase, or a total break of 64 in. (1.63 m.) on a single-phase circuit. Each break occurs in a separate oil vessel of seamless drawn steel tested to a very high pressure. The contacts open and close at a speed of about 5 ft. (1.5 m.) per second, and the circuit is not ruptured until the moving parts have been accelerated to that speed. Each oil vessel contains baffle plates which smother the arc and reduce the tendency of the oil to leave the vessel. This arrangement imposes upon the arc a pressure much in excess of that due to the head of oil and cools down the oil gases,

thus minimizing the risk of explosion above the oil switches. The switches are made in two forms, one with 8-in. (20.3-cm.) and the other with 10-in. (25.4-cm.) diameter of oil vessels. The capacity of the former is intended for a range from 2000 amp. at 15,000 volts to 100 amp, at 70,000. volts, and the latter from 4000 amp. at 15,000 volts to 300 amp. at 70,000 volts. A third form with 12-in. (30.5-cm.) oil vessels and still larger capacities is in process of design.—*London Times Engineering Supplement*, June, 1918.

Norwegian Water Power.—One of the largest water-power developments of Europe is that proposed for the Norwegian government known as the Laagen development, where 320,000 hp. will be installed. The energy is to be derived from lakes about 1260 ft. (384 m.) above sea level, taking the water from a drainage area of about 770 sq. km. According to the plans, there are to be two power houses, known as the upper station at Rodburg, where there will be twelve units of 21,500 hp. each, and the lower power station at Vrenne. The available head varies between 342 m. and 324 m.—*London Times Engineering Supplement*, June, 1918.

Traction

High-Speed Circuit Breaker.—A large circuit breaker to prevent flash-overs on 3000-volt direct-current generators has been installed for use by the Chicago, Milwaukee & St. Paul Railway. It is a single-pole magnetic blow-out type rated at 3600 volts, 3000 amp. direct current. The breaker and mechanism form a self-contained unit mounted on a structural-iron framework with cast-iron base. The operating mechanism is sc arranged that the breaker can be closed either by hand or by a motor controlled from the switchboard. The main contacts are of the laminated brush type, the brushes forming the stationary contact. The movable contact is a solid copper forging made as light as possible in order to reduce to a minimum the mass to be moved in operation. The blow-out and trip coils are connected in series so that the blow-out coils are excited at all times, as the usual arrangement of such blow-out coils was not found to give sufficient speed of blow-out. The main and secondary contacts are operated by a nest of compression springs which exert a force of 8000 lb. (3629 kg.) when the breaker is adjusted for operation. The tripping is accomplished through a train of latches and levers actuated by a solenoid, the magnet frame and core of which are specially laminated to obtain a quick magnetic response to the short-circuit current. Calibration, in order to take care of the varying number of units in several stations, is obtained by means of an adjustable tension spring directly opposing the pull of the solenoid. The rate of separation between the main and secondary contacts is approximately 8000 ft. (2438 m.) per second, and they are released in a time as short as 0.003 second or less from the beginning of a short circuit. This compares with about 0.10 second to 0.15 second, the speed of ordinary switchboard-type breakers.—*Electric Railway Journal*, July 27, 1918.

Installations, Systems and Appliances

Magneto Ignition for Farm Tractors.—J. G. ZIMMERMAN.—The author points out that poor judgment is used in the location of magnetos on tractors, stating that the magneto should be placed where it is out of danger of injury but still in an accessible position. On account of faulty selection of the wiring, energy is often lost between the magneto and spark plug, which may serously weaken the start. The essentials of a good spark are, according to the author, first a good kick voltage high enough to break down the spark gap and then a rapid follow-up current of fixed value which will be right on the heels of the break-down across the gap. The author discusses the type of starting devices which should be used on slow-speed traction engines employing low-grade fuel, pointing out that the old make-and-break spark may be advantageous for this use. The problem of producing a satisfactory spark during the cranking operation is also discussed. The article is illustrated by many oscillographic tests.—*Journal Society of Automotive Engineers*, June, 1918.

How to Save Fuel Oil.—ROBERT SIBLEY and C. H. DELANY.—A pamphlet has been prepared by J. M. Wadsworth, United States Bureau of Mines, for the Fuel Administration, on details of the economical use of oil fuel. The various suggestions in the pamphlet are amplified and explained by Messrs. Sibley and Delany to make these points of most practical value to operators.—*Journal Electricity, Power and Gas*, July 1, 1918.

A Steel Works Electrification.—The plant of the Frodingham Iron & Steel Works, Scunthorpe, Lincolnshire, has been electrified for the purpose of increasing the output. Of special interest is the replacement of a large engine by a 750-hp. direct-current motor with heavy flywheel to take momentary overloads. This motor can be almost instantly disconnected from the rolling mill which it drives for the sudden stopping of the roll. The motor and flywheel were put in place of the engine on the same foundation with only eleven days' interruption to the service. The electrical equipment was furnished by the General Electric Company, Ltd. of Witten.—London *Electrical Review*, June 28, 1918.

Electrophysics and Magnetism

Thermal Insulation.—R. B. FEHR.—More attention should be given to the matter of surface resistances, which, in the cases of glass or other poor insulators, constitute practically the total resistance, says the author. The velocity of the air on the warm side of the wall probably exerts as much influence on the total surface resistance as the velocity of the air on the cool side. The total surface transmission (both sides) for cork board, glass and building paper, in the usual ranges of temperature for conditions involving slight air movements, is not far from 25 to 30 B.t.u. per twenty-four hours per square foot per degree Fahrenhent. In the case of poor insulators it rises to about 50, for a moderate velocity on the warm side and a higher velocity (1000 ft. per minute) on the cool side. For "dead-air" spaces ½ in. (1.27 cm.) wide formed by ordinary building paper, and for the usual temperature differences, the transmission varies inversely as the number of exposed surfaces, the value for one layer (or two surfaces) being practically 25 (twenty-four-hour basis). Properly arranged, inexpensive air spaces can be made as effective as the same thickness of the best insulating materials on the market.—*Pennsylvania State College Bulletin*, Feb. 15, 1918.

Effect of Hydrogen on the Electrical Resistivity of Carbon.—T. PECZALSKI.—The effect of hydrogen on the electrical resistivity of carbon has been studied at different temperatures and pressures and it has been found that: (1) Hydrogen apparently produces no effect on the resistivity at ordinary temperatures for pressures up to 33 atmospheres; (2) the resistance of carbon increases considerably when the filament is heated to a high temperature (1590 deg. K. brightness temperature) in hydrogen; (3) the resistance at room temperatures following such a heating in hydrogen shows a similar and more marked increase; (4) subsequent heating of the filament in vacuum to the same temperature produces the opposite effects; (5) the effect is greater for the higher pressures than for the lower pressures, and (6) these changes are suggestive of an exponential law and are about equal in magnitude in cases where the filaments are not injured appreciably by the processes involved.—*Nela Research Laboratory Bulletin*, November, 1917.

Electrochemistry and Batteries

Electrolytic Deposition of Alloys, VIII, Iron and Iron-Nickel at Ordinary Temperature and High Hydrogen Pressure.—R. KREMAN and H. BREGMESSER.—The equilibrium potential of hydrogen with respect to pure water being — 0.41 volt, and that of iron in normal solution of FeSO — 0.46 volt, the electrolyte becomes depleted of H-ions in the immediate neighborhood of the cathode, and hydrogen and hydroxyl are deposited with the iron. To prevent this the electrolysis should be conducted in hot concentrated solutions, preferably of iron chloride, which is more soluble than the sulphate. For working at low current densities the electrolyte may be acidified, but the current yield is lowered in such case. A distinction has to be made between the gas pressure of the hydrogen in the electrolyte and the hydrogen dissolved in the iron. To keep the latter percentage low, the gas pressure of the hydrogen should be high (not low). The presence of hydrogen is generally supposed to render the iron hard and brittle, especially on the side in contact with the cathode, but the authors suggest that the brittleness depends upon a certain structural rearrangement which can be avoided by keeping the bath hot (75 deg. C.) and neutral. The magnetic properties of the iron are hardly affected by the conditions of the electrolysis. Deposited under hydrogen pressure from normal $FeSO_4$, the iron at once shows the equilibrium potential, which it only reaches after a considerable time under other conditions. Attempts to improve iron-nickel alloys by working under high hydrogen pressures failed. Mixed ferrous and nickelous sulphates yield alloys poorer in nickel than the bath, and the alloys are brittle; the two metals do not appear to alloy when electrolytically deposited together.—*Science Abstracts, Section A*, May 31, 1918 (abstracted from *Monat. d. Chemie*, December, 1917).

Current Rushes.—Some observations of heavy transient currents have been made by Prof. E. W. Marchant in the distribution systems of the Liverpool Corporation with an oscillograph. When a transformer was switched into an alternating-current supply system dangerous currents did not occur at 100 cycles or 50 cycles, but very large currents were observed with 25-cycle transformers. These currents depend not only upon the point of the voltage wave at which the circuit is closed but also upon the magnetism remaining in the iron. In tests made with a bank of three 100-kw. step-down transformers switched into the mains the maximum value of the current rush was over ninety times the steady magnetizing current. Tests made with a 300-hp. induction motor generator coupled to a 220-kw. continuous-current generator showed an extreme current rush of ten times the full-load current when the induction motor was switched in. The pressure curve remained quite steady during these tests, thus accounting for the large value of the currents. Oscillographic records of other transitory phenomena showed more or less striking results.—*London Times Engineering Supplement*, June 1918.

Miscellaneous

Blind People in the Electrical Industries.—Sir Arthur Pearson, in the interest of blind soldiers in Great Britain, has suggested that the work of winding armature coils can be done by the blind. He has succeeded in interesting others in the enterprise, so that experiments are now being conducted at the Birmingham Royal Institution for the Blind to test the blind in coil winding.—London *Engineering*, July 21, 1918.

German Substitutes for Copper.—F. NIETHAMMER.—Owing to the war, connections to busbars on switchboards and for the various pieces of apparatus have had to be made of substitutes for copper, mainly Al, Zn, Fe, and an alloy called "electron," which has a density of 1.8 and is mainly composed of Mg. The author considers the general principles on which the sizes of these conductors should be determined.—*Science Abstracts, Section B*, May 31, 1918 (abstracted from *Electrot. u. Maschinenbau*, Jan. 27, 1918).

Necessity for Inspection and Testing of Refractory Brick.—C. E. NESBITT and M. L. BELL.—Many instances can be cited where bricks of poor quality have been accepted without knowledge of their inferiority, resulting in the premature failure of the furnace or other structure. Much of this loss could have been avoided if the bricks had been tested before being put into service. A great deal can be accomplished by careful visual inspection, by means of which all bricks irregular in shape or size, fire-cracked, improperly molded or of poor general appearance would be eliminated. If proper care is taken in the brick plant, this rejection need not be a very large percentage of the output.—Extracted from paper presented before the American Society for Testing Materials, June 25-28, 1918.

Frequencies.—B. G. LAMME.—The author refers to factors that have influenced the selection of certain frequencies at different times and says that it is surprising that a wider range has not been considered. Occasion has arisen times without number where an obvious solution of a given problem would lie in modification of the frequency to allow the use of apparatus and equipment already designed, but the engineers of manufacturing organizations have steadily held out against such policy, regardless of the apparent need of the moment. The swing of the pendulum from 60 cycles and back has covered a period of many years and therefore cannot be considered as a fad of the moment, but is the result of well-defined tendencies, supported by experience.—*Electric Journal*, June, 1918.

THE DEVELOPMENT OF THE ELECTRICAL SEARCHLAMP

Inferences Regarding German and American Patents in Recent Article Disputed

To the Editor of ELECTRICAL WORLD:

Sir: I wish to enter a protest against the inaccurate article appearing in the issue of the ELECTRICAL WORLD of June 22, 1918, entitled "Development of Electrical Searchlamps," by Louis J. Auerbacher. The author appears to have gone out of his way to bring into prominence the Imperial German Patent Office, the imperial German patents, Gebr. Siemens & Company of Charlottenburg, Heinrich Beck of Meiningen and several other Germans. The excellent work of Mrs. Hertha Ayrton of London, of the great French physicist, A. Blondel—the pioneer and recognized authority on flaming arcs—and of a host of our own American inventors is passed without mention. The fact seems to have escaped the author that the flaming arc commonly known as the inclosed arc received its first great impetus in America.

UNITED STATES ANTEDATES GERMANY

As an example of the claims made in the article it may be pointed out that Mr. Auerbacher cites the German patent 210,251 to show a development in providing a metal coating on an electrode, whereas this had been done in the United States as early as 1893—or fifteen years before the German patent cited appeared. (See United States patent to Siebold of New York, No. 498,141, May 23, 1893.) Furthermore, the inclosure and protection of a carbon by tubes appeared before any of the German patents cited in the article appeared. (See United States patent to André Blondel of France, No. 764,105, July 5, 1904.)

The German patents cited by the author have in most cases equivalents in United States patents, but only in the case of Beck does he cite a United States patent, and in this instance also he takes occasion to cite the German patents. For instance, the United States equivalent of the German patent No. 203,549 is U. S. patent to Viertel, No. 969,814, Sept. 13, 1910, and United States equivalent of the German patent No. 210,251 is U. S. patent to Kalkner, No. 916,877, of March 30, 1909. Other instances could doubtless be found.

The only searchlight patent mentioned issued to an American—or, for that matter, any one outside of Germany—is the patent of Elmer A. Sperry, which is not only branded by the author as disclosing nothing new but is also given an incorrect number. The correct number of the patent is 1,227,210. Where the author got the number 221,917 from I am at a loss to understand. This patent is not the only proof of Mr. Sperry's work in connection with high-intensity lights (see British patents Nos. 12,999 and 102,971, which Mr. Auerbacher evidently overlooked). The United States

Readers' Views and Comments

patents corresponding to these British patents are not yet published. British patent No. 12,999 discloses the Sperry system of air cooling, whereby the employment of alcohol is rendered unnecessary. This system has entirely superseded the alcohol system in this country. The second British patent contains an interesting scientific discussion of the high-intensity arc.

There is one point in which the author is correct, however, and that is the alcohol "breath" in which Beck undertakes to burn his arc. This is characteristically German and comprises the German contribution to this art, in the writer's opinion. The author, however, does not seem to be aware that the Sperry system with its great simplicity has rendered the association of all such wholly extraneous substances as alcohol and the like with an arc entirely unnecessary and obselete. The article in question seems to be a sort of last gasp to rehabilitate this totally discredited practice of using the alcohol flame. The author distinctly states that its use is for the prevention of oxidation and consumption of carbon. He does not seem to be aware that by official tests on the part of some twelve officers of our army it was demonstrated that a given length of carbon of the identical dimensions would burn longer in the Sperry lamp and give more light than it would in the Beck lamp. These tests were extremely exhaustive and conclusive, and one of the results was the decision to abandon the more complex lamp and system in favor of the simpler one.

In addition, the author, in describing Sperry's American searchlight lamp, makes a gross misstatement. He states —in the second column on page 1321— that in the Beck lamp the consumption of the positive electrode is only 200 mm. to 240 mm. per *hour*, and that in the Sperry lamp it is 13½ in., or 343 mm., per *minute*. Whether such a gross misstatement of facts is intentional or not I do not know, but the facts, as stated above, are that the consumption in the Sperry lamp, instead of being sixty times greater, is in reality less than in the Beck lamp.

GERMAN LAMP PRACTICALLY OBSOLETE

The article gives the impression to the reader that the Beck lamp is superior to all other types of lamps used in this country or elsewhere. It seems only fair to correct this impression, since at the present time the Beck system of operating searchlights is practically obsolete, having been completely superseded both by the Sperry system as disclosed in the Sperry patent and by other systems. The Beck system of operation was rendered obsolete for the following reason, among others, that it could not be utilized for anti-aircraft work—a field which has been recently opened and which at present constitutes one of its greatest applications.

In addition to the fact that the searchlight beam is invaluable for apprehension of aircraft at night and as an aid to anti-aircraft guns, it has been discovered that if an aeroplane can once be brought within the intense beam of a searchlight the pilot and all observers in the aeroplane are rendered perfectly helpless by the dazzling effect of the glare, and it has also been determined that there is no difficulty whatever in keeping the aeroplane in the beam after it has once been spotted, no matter what maneuvers or sudden moves are resorted to by the pilot to escape the beam. The Beck system, in exhaustive government tests, was found to be too complicated for operation under service conditions, as stated.

AMERICAN LAMP A GREAT ADVANCE

The Sperry system with the air-cooled electrode holders and the elimination of alcohol or other cooled gas around the arc proved to be a great advance step in the field of high-intensity searchlights. That such advance has been made is recognized by the government both by the grant of letters patent to Sperry and by wide adoption of his light.

Regarding further the priority of development claimed for German investigators, it may be pointed out that it was old to rotate and feed the positive electrode in a searchlight as far back as 1893, as shown in patent No. 493,359, issued to R. M. Hunter of Philadelphia, March 14, 1893. It was also old to burn an arc in a flame or inert gas, as shown in the United States patents to N. S. Keith of New York (No. 246,517, Aug. 30, 1881) and to L. Colburn of New Haven (No. 316,340, April 21, 1885). The idea of operating electrodes with high-current density was known in the United States as early as 1882. (See U. S. patent No. 255,466 to Charles W. Siemens of England, March 28, 1882. In this patent the negative electrode was heated to such a temperature that it was necessary to cool it by water jacketing.)

The development of the modern searchlight was based essentially upon the flaming-arc carbon, which, as we heretofore stated, was developed largely in the United States, and which fact is totally ignored by the article. (See United States patent No. 527,826 to Acheson, Oct. 23, 1894, and others.) We, of course, do not deny that a great deal of credit is due the German engineering firms for certain developments, but an attempt to prove that the modern high-intensity light is the result of development of thin electrodes for the old-style pure carbon lights is absurd.

HERBERT H. THOMPSON,
Secretary Sperry Gyroscope Company.
Brooklyn, N. Y.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

BOSTON EDISON COMPANY SELLS $3,000,000 NOTE ISSUE

Proceeds of Four-Year 7 per Cent Securities Will Provide for Increased Generating and Distribution Facilities

The Edison Electric Illuminating Company of Boston has sold $3,000,000 of four-year 7 per cent notes, dated Aug. 1, to Lee, Higginson & Company, Old Colony Trust Company, F. S. Moseley & Company, Kidder, Peabody & Company and Parkinson & Barr. The notes were sold to the public on a 7.10 per cent basis. Proceeds of the issue will provide for increased generating and distribution facilities to accommodate the large growth in business, due partly to greater war requirements.

INDIANAPOLIS COMPANIES DEMUR AT CITY PAYMENTS

Pending Outcome of Surcharge Controversy, Merchants' Company Refuses to Turn Over Percentage on Gross Receipts

The Merchants' Heat & Light Company of Indianapolis, which has the city contract for lighting the streets of that city, has notified the Indianapolis officials that it will not pay at this time 5 per cent of the gross receipts received from the city under the lighting contract to the city as part of the regular franchise tax of the company. The amount involved is between $8,000 and $9,000.

The city of Indianapolis, through its Board of Public Works, is refusing to approve claims filed by the heating and lighting companies for war surcharges allowed by the Public Service Commission. The city in this case takes the position that it is not bound by the order of the commission. Both the Merchants' company and the Indianapolis Light & Heat Company are refusing to pay the regular franchise tax to the city because they have surrendered their franchises to the Public Service Commission under the Indiana utility law and are operating under indeterminate permits. The amount involved is approximately $75,000 a year.

According to the Merchants' Heat & Light Company, that company is not refusing to pay the 5 per cent franchise tax under the street-lighting contract, but is holding payment in abeyance until it can be determined what action the city finally will take in regard to the surcharge payments.

The company says the city now owes it approximately $30,000 in surcharge payments. Both electric companies now have petitions before the Public Service Commission asking for a renewal of the authority to collect surcharges on all bills because of war-time increases in the cost of materials, labor and fuel.

PERSONNEL OF UNDERWRITERS' ELECTRICAL COMMITTEE

Dana Pierce Appointed to Succeed Chairman Cabot, Who Resigned, and New Members Have Been Added to the Committee

Dana Pierce of New York has been appointed chairman of the electrical committee of the National Fire Protection Association, succeeding F. E. Cabot of Boston, who recently resigned.

The history of this important and well-known committee, which has charge of the National Electrical Code, extends over twenty-two years, during all of which period Mr. Cabot has been its chairman. His services to the electrical industries in this work have been recognized as of great value, and his resignation, due to the pressure of other duties, will be regretted by his wide circle of friends in the electrical field.

The new chairman, Mr. Pierce, is a vice-president of the Underwriters' Laboratories, Inc., and is well known as the electrical engineer of that institution. He has been a member of the electrical committee for the last ten years.

The following new members of the committee have also been recently appointed: Dr. Morton G. Lloyd of the Bureau of Standards, Washington (replacing W. J. Canada); K. W. Adkins of the Missouri Inspection Bureau, Kansas City, Mo.; F. F. Burroughs of the Mutual Fire Prevention Bureau, Oxford, Mich.; C. B. Landon, Factory Insurance Association, Hartford, Conn.; A. N. Miner, Jr., Underwriters' Bureau of New England, Boston, and H. R. Sargent, Schenectady, N. Y., representing the Associated Manufacturers of Electrical Supplies.

Electric Sign Spurs War Stamp Salesmen

Stretching across one of the corners from which five important Indianapolis streets radiate is an electric sign which tells what progress captains of war-savings sales teams are making. The captains' names are given on placards above the sign, and in front of each placard is a lamp.

COMMITTEE ON POWER UNIFICATION IN ILLINOIS

Body Reporting to Fuel Administration on the Coal Saving Is Headed by L. E. Meyers of Chicago

The Illinois Fuel Administration has appointed a committee on power unification and utilization. The committee is made up as follows: L. E. Meyers, chairman, president of the L. E. Meyers Company, Monadnock Block, Chicago, representing the public utilities; Wallace G. Clark of the Sanitary District, representing state municipalities; Clarence G. Mark, secretary, representing Chicago manufacturers; Fred J. Postel, supervising engineer, Department of Public Works and Buildings, representing the state government, and Charles H. Ewing, of Decatur, representing manufacturers in the southern district of the state.

Data regarding conditions in industries in Cook County will be gathered by Harold Almert and facts from other parts of the state by Joseph Harrington. Both of these gentlemen, who are chairmen of engineering boards, are established consulting engineers of Chicago. It is stated that the elimination of superfluous plants will be brought about by negotiations, where this is possible, and by withholding coal where the concerns are stubborn.

USE OF EFFICIENT STATIONS TO CONSERVE COAL SUPPLY

President Harriman of the New England Power Company Says that 40,000 Kw. Additional Capacity Is Needed for Next Winter

President Henry I. Harriman of the New England Power Company recently discussed the power outlook before the Massachusetts Gas and Electric Light Commission and emphasized the importance of coal conservation through the maximum use of the most efficient stations. Mr. Harriman said that at present the company has practically no secondary power, substantially all the contracts now in force being on the primary basis.

In 1916 the company produced 236,000,000 kw.-hr. from water and 9,000,000 kw.-hr. from steam; in 1917 the hydroelectric output was 245,000,000 kw.-hr. and the steam output 54,000,000 kw.-hr., due to the growth of the load. It is estimated that 116,000,000 kw.-hr. will be delivered by the steam plants connected to the system this year and that the hydoelectric output will be about the same as last year. Since last winter the company has been supplied in part by the 45,000-kw. turbine of the Narragansett Electric Lighting Company in Providence, R. I.

At present it is extremely difficult to provide additional power, even on old contracts. A demand for 10,000 kw. a few days ago from a central station in Massachusetts could not be met at this time, but the possibilities of such a supply are being studied with care.

Under good conditions, Mr. Harriman stated, a large modern turbine plant will operate at 2 lb. of coal or a little less per kilowatt-hour, and in the case of the Providence company 1.85 lb. has been attained at times. The fuel consumption per unit of output depends on the load factor and many other conditions. Very few manufacturing plants can do better than 3 lb. Occasionally a very large industrial plant will improve on this figure, but the average 1000-kw. plant is very fortunate if it gets energy at 3 lb. In these days it is almost a crime to burn 3.5 lb. to 4 lb. when 2 lb. would do the work.

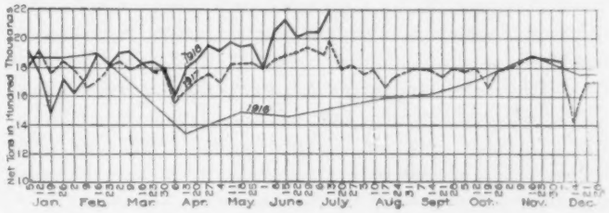
On the New England company's system the outputs and the peak loads follow each other very closely. There is a winter peak, but it is relatively small compared to that of an electric light company. This year the company plans to use the water in its Somerset reservoir, on the upper Deerfield River, practically on peak load business alone, barring accidents. The flow of this stream cannot be allowed to fall below a minimum of 200 sec.-ft. In the past, before the load was so large, that water could be used to keep the flow up to 300 or 400 sec.-ft. This year the water must be saved for November, December and January, when it can be let down at the rate of 600 or 800 sec.-ft. in order to run the plant during the peak hours of these months at maximum capacity.

A mere statement of hydroelectric development does not show what a plant will turn out. At the company's Vernon plant on the Connecticut River, by drawing 2 ft. the station can be run at practically full capacity (20,000 kw.) for two or three hours, so that even in low-water times this plant can be run at 500 kw. during the day and at 20,000 kw. for two hours in order to handle the peak. Last winter the system peak load reached 72,000 kw., and in June it was running about 65,000 kw. Last year the New England company purchased about 35,000,000 kw.-hr. from the Turners Falls Power & Electric Company, but this year the latter has sold so much of its capacity that the New England company may not be able to get over 12,000,000 kw.-hr. from this source and will therefore be obliged to increase the steam output as the water resources are diminished.

An additional capacity of at least 40,000 kw. is needed for next winter's load. Some relief may be gained by rearranging the hours of operation of the factories in New England to avoid overlapping lighting and power peaks. If the daylight saving plan is carried throughout the year, it will mean the saving of hundreds of thousands, perhaps millions, of horse-power of capacity in the country.

Bituminous Output Is Now Better

According to the Geological Survey, the bituminous output in the week ended July 13 was 13,243,000 net tons, an increase over the five-day week of July 6 of 2,987,000 net tons, or 29 per cent, and over the corresponding week of last year of 1,479,000 net tons, or 12.5 per cent. The weekly output of 13,243,000 net tons is approximately 1,031,000 net



tons, or 8 per cent, above the average weekly requirements of 12,211,500 tons estimated by the United States Fuel Administration. However, the average weekly production for the coal year to date is estimated at 11,568,000 net tons, or 5.3 per cent behind the weekly requirements.

ELECTROCHEMICAL SOCIETY ACTION ON ALIEN MEMBERS

Resolutions Passed by Directors Provide that Members Shall State Whether They Support Our Aims and Ideals

Directors of the American Electrochemical Society have passed the following resolutions:

Whereas a communication has been submitted to the board of directors bearing the signature of sixteen members, in accordance with paragraph 5, Article III of the constitution, requesting "that all members of the society who are subjects of Germany or Austria be dismissed, on the ground that they are opposed to the United States of America in its war for the preservation of civilization, and are consequently enemies of the majority of the members of our society," therefore be it

Resolved, That it is the sense of this board that all members of the society who are enemy aliens and who are in sympathy with the enemies of the United States of America in the present war should be dismissed from membership on the grounds above set forth, and

Resolved, That the secretary be instructed to send a copy of this resolution to all such members requesting that they either appear in person at the meeting of the board of directors to be held at the Niagara Club, Niagara Falls, N. Y., Saturday, Aug. 24, 1918, at 11 a.m., or file answer by letter, stating whether or not they support the aims and ideals of the United States of America in the present conflict.

Members have therefore been asked to state by notice to the secretary, Joseph W. Richards, their nationality and citizenship.

GOVERNMENT ATTITUDE ON THE COMMERCIAL MEN

Questions Affecting Services of Salesmen of Central-Station Companies Are for the Local Draft Boards to Settle

Managers of commercial departments of central-station companies who are anxious to do their full duty and more in aiding the government to win the war, and at the same time do their full duty to the public in the distribution of labor-saving devices of an electrical character, as well as their full duty to their companies in conserving the supply of employees, such as salesmen, should take up with local draft boards each and every question of a saleman's services, under the recent ruling of "work or fight," issued by the Provost Marshal General.

This information, furnished by the Washington correspondent of the ELECTRICAL WORLD, was obtained at the office of the Provost Marshal General. A request for an interpretation of the "work or fight" order as it applies to the commercial departments of central-station companies was met at the General's office in Washington with the statement that ordinarily the employees of such commercial departments would come under the classification of sales clerks in commercial establishments, but that there are so many salesmen of electrical devices who are highly skilled in electrical work of other character that the best way of settling the question of whether such salesmen are occupied in essential work is to consult local draft boards.

It was pointed out by the correspondent of the ELECTRICAL WORLD that the managers of the commercial departments throughout the country in ninety-nine cases out of a hundred are willing to go beyond the strict requirements in giving up men whenever necessary, and at the office of the Provost Marshal General it was said that this was realized. It is also realized that many companies have in their employ men selling vacuum cleaners, washing machines, heating devices, percolators, flatirons, etc., which are labor-saving devices, and that these men in many cases have skilled knowledge of electrical matters which might make them valuable and essential to their employers in fields other than salesmanship or in addition to salesmanship. For this reason, it is stated in Washington, local draft boards will be required to take up each and every case along this line on its merits.

CALIFORNIA REGULATIONS CURTAILING ELECTRICITY

Order of the California Power Administrator Resulting from Reductions in the Supply by Drought Affects Many Industries

The order of the California Power Administrator, H. G. Butler, regulating the use of electricity in northern and central California because of the depletion of the supply by drought, was mentioned in last week's issue of the ELECTRICAL WORLD. The order affecting signs reads:

1. Effective during August and September, 1918, except Saturdays, Sundays and legal holidays, no electrical energy shall be used: (a) For advertisements, notices, announcements or signs designating the location of an office or place of business or the nature of any business; (b) for external illumination for ornamentation of any building; (c) for lights in the interior of stores, offices or other places of business when such stores are not open for business; d) for excessive street lighting intended for display or advertising purposes.

2. This order shall not be construed to prohibit the furnishing of electricity for such lights as may be required by law or public safety.

The brewery order forbids power companies to take on new brewery business until further notice and required that the brewery load carried should be reduced 50 per cent on Aug. 1.

Cement manufacturers and large irrigation companies have agreed with the Power Administrator to shift their heavy usage of electric energy from day to night. Gold dredging companies have accepted a regulation by which their electric consumption is cut considerably.

The orders were decided upon after a conference of several hours between Power Administrator Butler and representatives of all the electric companies in northern and central California. The district includes the tier of counties above Merced County. These companies were in hearty accord with Mr. Butler and stated an intention to send to each consumer and to have published in all newspapers in their territory the following card, headed "Conserve Electricity":

Patriotism demands that you save electricity for war industries.

Northern and central California have a serious power shortage because of lack of rain during the past winter and the increased use of electricity by war industries.

These war industries must have power.

There is not enough power for everybody at the present rate of consumption. It is up to you to save. Turn off your lights whenever possible and use lower power lamps.

This is one other thing you can do in the great struggle.

The Power Administrator has written to the mayors

and officials of cities and counties stating the absolute need of conserving electricity and asking that every endeavor be made to reduce the use of energy for public or private purposes.

The Power Administrator has stated that the shortage of electricity over normal, caused by the lowering of water in the rivers and streams of northern and central California from which electric power is taken and also by the unprecedented demand for electricity by war industries, has made it essential to decrease the consumption of electrical energy in northern and central California by 20 per cent. He figures that the saving made by these orders and requests will partly meet the shortage and that future orders will be made to bring the district through the crisis.

SEATTLE SEEKS FUNDS TO DEVELOP THE SKAGIT RIVER

More Hydroelectric Energy Needed to Care for Industries and Stabilize Power Production in Puget Sound District

The municipal authorities of the city of Seattle have filed a statement with the Capital Issues Committee at Washington in behalf of an application by the city of Seattle for the approval of $5,500,000 for light and power bonds with which to erect a hydroelectric development on the Skagit River. The Mayor of the city, the chairman of the finance committee, its corporation counsel and R. H. Thomson, former city engineer, were in Washington this week to press the case before the Capital Issues Committee.

The statement filed traces the growth of the municipal electric light system of the city of Seattle, which comprises a hydroelectric development on Cedar River and a steam plant in the city of Seattle, from its inception. It is now proposed to erect a 35,000-kw. hydroelectric plant on the Skagit River. If it were not for the war, work on this plant would be under way.

Desiring to coöperate with the federal government in carrying on the war, the city of Seattle, however, applied to the Capital Issues Committee of the War Finance Corporation last April for its approval of a bond issue to carry out the development. The matter was referred to a sub-committee at San Francisco, where an issue was raised as to the necessity for more power at this time. The city representatives of Seattle point out that the municipal light and power plant has at all times been run and is now being run for the benefit of the public and that the city officials had also determined that an actual necessity existed for more power. However, in order to verify the correctness of the conclusion, a careful investigation was made by the city through its engineer, A. H. Dimmock; its superintendent of lighting, J. D. Ross, and R. H. Thomson, who for nineteen years prior to 1912 was the city engineer. In addition, M. M. O'Shaughnessy, city engineer of the city of San Francisco, was employed to make a personal investigation and report on the urgency for further development of electric power.

The unanimous opinion of the engineers is that it is necessary at this time for the city to undertake the development of a large amount of additional hydroelectric power. The four engineers found the following to be the situation as regards the supply and the demand for electrical energy at Seattle:

Maximum theoretical energy which can be produced most favorable conditions by hydroelectric plants:

Puget Sound Traction, Light & Power Company:	Hp.
White River	61,330
Snoqualmie	26,330
Electron	18,660
Cedar Falls, city of Seattle	13,860
Total hydroelectric	120,180
Less 20 per cent loss between waterwheel and customer	24,036
Usable hydroelectric energy	96,144

Maximum theoretical energy which can be produced from steam:

Puget Sound Traction, Light & Power Company:	Hp.	Hp.
At Georgetown Station—		
One generator	10,666	
One generator	4,000	
At Post Station—		
One generator	4,267	
Seattle city plant, total of	26,660	
Total steam	45,593	
Less 10 per cent loss from plant to consumer	4,559	
Total usable from steam		40,934
Total hydroelectric energy, as above		96,144
Total usable energy		137,078

In reference to the foregoing statement of supply there must be considered the Tacoma municipal plant. This plant can produce at times of high water 26,667 hp., and during the high water of 1917, when one of the generators at the White River plant, mentioned above, was out of order, this plant furnished considerable relief. All excess electricity above the Tacoma demands, however, has been sold to and is now being used by the American Nitrogen Products Company. Therefore this plant cannot be considered as a source of supply.

The maximum usable power of 137,078 hp., as detailed above, in the Seattle district can be generated only when all steam and hydroelectric machinery is in perfect condition and water is abundant. The run-off of the various streams is extremely variable. Cedar River varies in run-off from 32 cu.ft. to 900 cu.ft. per second. One second-foot at the Cedar Falls plant will produce 37 hp. The stream, therefore, at extreme low water, without storage, would only produce 1184 hp., instead of the maximum of 14,000 hp.

Puyallup River, supplying the Electron plant, varies in flow from 120 cu.ft. to 1620 cu.ft. per second. One second-foot there will produce 62 hp. Thus at low water the Electron output is reduced from 18,660 hp. to 7500 hp. The committee points out that during the winter months, owing to the fact that the Electron plant derives its energy from water furnished from the run-off of the Mowitz Glacier on Mount Rainier through a wooden flume more than 10 miles in length, in which the water sometimes freezes solid, it is not uncommon for this plant to be out of commission for lack of water for a considerable period of time, and it cannot be depended upon at any time to furnish more than 18,660 hp.

The Snoqualmie River, supplying the Snoqualmie plant, varies in flow from 321 cu.ft. to nearly 12,500 cu.ft. per second. One second-foot will produce 19 hp. at this plant, and the output of this plant from lack of water actually drops from 26,330 hp. to 6100 hp.

The flow of the White River, supplying the White River plant, varies from 420 cu.ft. to 3700 cu.ft. per second. One cubic foot per second there produces

40 hp. The output may thus vary from the maximum of installation, 61,330 hp., to 16,800 hp.

The Nisqually River, which supplies the Tacoma plant, varies in flow from 220 cu.ft. to 4800 cu.ft. per second. One second-foot there will produce 33⅓ hp., so that plant may fall from its rated capacity of 26,667 hp. to 7333 hp.

These facts put in tabular form show the variation of supply from hydroelectric plants to be as follows:

	Possible Maximum, Hp.	Possible Minimum, Hp.
Cedar River	14,000	1,184
Electron	18,660	7,500
Snoqualmie	26,330	8,100
White River	61,330	16,800
Tacoma	26,667	7,333
Total	146,987	36,917

The Cedar River plant has storage in Cedar Lake which will run the plant at full capacity for about twenty-three days.

The Electron plant has no storage other than in the forebay; this would operate the plant for one hour only.

Snoqualmie has storage to run the full plant for but four and one-quarter hours.

The White River plant has storage to operate the plant for sixteen days at full load.

Nisqually has storage for two hours only.

It is not expected that all these plants will or may become disabled or reduced to a minimum at the same time, although that happened in 1915 and will probably occur again this year owing to lack of snow in the mountains. The facts, the committee contends, show that the possibility of furnishing even a fairly uniform supply of electric energy to the Seattle district is next to nothing under existing conditions, and that a failure to hasten every effort to increase and stabilize the power production of the district would be criminal neglect.

This condition is emphasized by the demand for energy as of Dec. 30, 1917; but on July 1, 1918, it had changed greatly, as illustrated by the following figures submitted by the committee.

MAXIMUM DEMAND FOR POWER

The maximum demand during 1917 was approximately as follows:

	Hp.	Hp.
From Puget Sound Traction, Light & Power Co.	103,333	
From city plant	24,260	
Total maximum demand during 1917		127,593
Thus leaving a theoretical surplus of		9,485
Up to July 1, 1918, additional demands have been made upon the municipal plant and contracts signed for		17,143
Notification has been given the management of the city plant that various plants will require an additional supply of		44,191
Making a total of		61,334
To furnish this amount of energy to customers will require the installation of additional machinery to produce		67,467
The demand which may have been, or which hereafter may be, made on private companies in addition to the demand as of Dec. 30, 1917, we do not know, but it must be very considerable. Disregarding that entirely, and remembering that as of Dec. 30, 1917, there was a theoretical surplus of but 9485 hp. in excess of the maximum demand, the increase, as indicated by the contracts made by the city, shows a shortage as of July 1, 1918, of 17,143 hp. less 9485 hp., or of		7,658
And considering the notification made, a probable shortage as of Dec. 30, 1918, of 67,467 hp. less 9485 hp., or		57,982

and this absolutely regardless of additional demands on private plants.

The development of an additional hydroelectric plant at this time, the committee says, is not the hastily conceived plan or freakish idea of any one, but is the logical and normal growth of a necessary municipal utility. Economy in the use of light and power has been urged, and the city has darkened many of its street lights in an effort to conserve fuel and the energy developed therewith.

Although within the State of Washington there is 9,920,000 potential water horsepower, of which only 3.3 per cent has been developed, practically two-thirds of the power being generated by the city is generated through the use of fuel oil. At the present time about 700 barrels of oil per day are being used by the city for this purpose, at a daily cost of $1,190. As winter approaches this will increase to 1000 barrels a day, causing a daily expenditure of $1,700, or an average yearly expenditure for oil of more than $500,000.

It is pointed out that the city could burn other fuel—coal by means of stokers or in powdered form, or mill refuse. Coal in Seattle averages about 10,000 B.t.u per pound, so that even if burned at the same efficiency as oil, it would require as the equivalent of 1000 barrels over 300 tons of coal daily. Stokers would require special coals, and the capacity of the boilers would probably be limited. Powdered-coal equipment would cost, with railway and land for storage, about $350,000. The time required to get this equipment, and to obtain the necessary lands by condemnation, would be nearly as long as it would take to build a 35,000-kw. hydro plant on Skagit River. As to the men used, counting miners, railway men, coal handlers and firemen, there would be about the same number of men employed on a coal-burning steam plant as in the building of a hydroelectric plant.

Summarizing, the committee urges that it is imperative that the city proceed at this time with the development of additional hydroelectric power, for the following reasons:

1. There is at this time no surplus of power (regardless of how generated) in the city of Seattle or deliverable thereat.

2. Assuming for the purpose of argument that a surplus of power exists at this time, there are two answers: (a) that it is generated by the use of fuel, while water power goes to waste, and by operating at all times steam auxiliary plants that were only intended as standby or emergency plants, leaving no reserve in case of accidents or disasters such as have heretofore actually occurred; (b) any apparent surplus will be wholly inadequate to care for the peak load of the coming winter, and no provision is being made for the peak load of a year from the approaching winter.

3. The actual condition of the city's existing hydroelectric plant, relying as it does upon the old wooden dam and penstocks and the wooden building, will stamp any course as criminal neglect which does not without delay make immediate provision for its relief at the earliest possible date. Obviously, a relief plant must be started or no relief can be had.

4. The city obtains its entire water supply for all purposes from Cedar Lake. The daily supply is 62,000,000 gal. Should the old wooden power dam go out, Cedar Lake would be lowered 14 ft., the result being that the city water supply would be entirely dependent upon the low water flow of the river, which at times has been about 32,000,000 gal. (approximately one-half of the present water supply).

PRIORITY REGULATIONS OF WAR INDUSTRIES BOARD

Circular No. 4 Issued to Simplify Administration of Priorities for Both Government and Manufacturer and to Expedite War Work

The priorities division of the War Industries Board has issued Circular No. 4 embodying a revision of its rules and regulations governing priority in production. The circular, which is signed by Edwin B. Parker as priorities commissioner, Bernard M. Baruch as chairman of the War Industries Board, Secretary of War Baker, Secretary of the Navy Daniels and Edward N. Hurley, chairman of the United States Shipping Board and president of the Emergency Fleet Corporation, will be mailed at once to all who have made application at any time for priority certificates and to all against whom certificates have been issued. They are asked by the priorities committee not to request copies unless they fail to receive them after a reasonable time has elapsed. Then copies may be procured on application to Maurice Hirsch, secretary of the priorities committee, Washington, D. C.

The new circular continues in effect Class AA, which comprises only emergency war work; Class A, which comprises other war work, and Class B, which comprises orders and work which, while not primarily designed for the prosecution of the war, yet are of public interest and essential to the national welfare or otherwise of exceptional importance. In order to secure rating within these three classes, application must still be made to the priorities committee on forms furnished on request, save in cases where provision is made for automatic classifications and the conditions for procuring automatic classifications have been strictly complied with.

The circular embodies, however, two fundamental changes:

First—The addition of Class D (corresponding to what was formerly Class C) and the creation of Class C as a class entitled to precedence.

Second—The establishment of automatic ratings.

Class C, as described in the new circular, comprises all orders and work not covered by priority certificates or automatic ratings but which are to be utilized in furtherance of one or more of the purposes embraced within what is designated as the "General Classification of Purposes Demanding Preference Treatment."

No Class C certificates are issued, but the orders designated within Class C are automatically so classified, provided that the person intending to use the materials, equipment or supplies files with and as a part of the order a prescribed affidavit in writing.

On direct government orders, the new circular provides that orders placed after June 30, 1918, by a duly authorized officer of the War Department, the Navy Department or the United States Shipping Board Emergency Fleet Corporation which fall within Class A shall, upon the placing of the order, automatically be classified as Class A-5, provided that the order carries an indorsement personally signed by the officer placing the order, as follows:

"Unless re-rated by express order in writing by the priorities committee of the War Industries Board, this order is by authority of said priorities committee rated as Class A-5, and its execution shall take precedence over all your orders and work of a lower classification to the extent necessary to insure delivery according to the date specified herein, as prescribed by Circular No. 4, issued by the priorities division of the War Industries Board, of date July 1, 1918, and all amendments thereto."

Automatic classifications are likewise allowed on orders for materials, equipment or supplies for the following specific uses:

(a) For the manufacture of turbines (all classes), A-4.

(b) For the repair or construction of steam railroad locomotives for use on the railroads under the jurisdiction of the United States Railroad Administration, A-4.

(c) For the production of electrodes, A-5.

(d) For the manufacture of rope wire and of wire rope, A-5.

(e) For the building of ships or other water craft for and under direct contracts with the United States Shipping Board Emergency Fleet Corporation, A-5.

(f) For the building of all cargo water craft (but not pleasure craft) save such as are under construction by or for the United States Shipping Board Emergency Fleet Corporation, A-6.

(g) For the manufacture of machine tools for working both metal and wood; of machinists' tools, of small tools, of hand tools, and of mining tools, machinery and equipment, A-6.

(h) For the manufacture of steam-railroad materials, equipment and supplies (other than locomotives) for use on the railroads under the jurisdiction of the United States Railroad Administration, B-1.

(i) For the manufacture of locomotive cranes and traveling cranes, B-1.

(j) For the manufacture of electrical equipment other than turbines (but not electrical supplies as distinguished from equipment), B-2.

(k) For the manufacture of farm implements, B-2.

(l) For the manufacture of textile machinery, B-2.

(m) For the manufacture of tools, implements, machinery and equipment required for the production, harvesting, distribution, milling, canning and refining of foods and feeds, B-2.

(n) For the manufacture of binder twine and rope, B-2.

(o) For the manufacture of oil-well supplies or equipment —by which is meant supplies for the production of petroleum and natural gas—but not including pipe lines, storage tanks of 1000 barrels capacity or over, tank cars or refineries, B-2.

However, before an order takes the automatic classification, it must be accompanied by a prescribed affidavit. Where the automatic rating will not secure reasonably satisfactory delivery, application for a higher classification should be made, such application disclosing facts evidencing that the public interest requires an earlier delivery of the order than can be secured under the existing automatic rating.

The circular calls attention to the method of securing a place on the preference list compiled by the priorities board, of which the priorities commissioner is chairman and H. G. Phillips is secretary. Applications must be made on a separate and distinct form of application, which may be secured from Mr. Phillips on request. The circular points out that the priorities committee does not issue priority on fuels, food or feeds, or transportation. The preference list compiled by the priorities board is used as a guide by the United States Fuel Administrator and the United States Railroad Administration in the distribution of fuel to industries and plants.

The new circular calls attention again to the test in requesting priority:

"The paramount purpose of priorities is the selec-

tive mobilization of the products of the soil, the mines and the factories for direct and indirect war needs in such a way as will most effectually contribute toward winning the war. In requesting priority the petitioner should join with the committee in applying the test: To what extent, if at all, will the granting of this application contribute, directly or indirectly, toward winning the war; and if at all, how urgent is the need?"

APPROVES RATE INCREASE FOR PACIFIC ELECTRIC COMPANY

California Railroad Commission Enumerates Factors Contributing to the Necessity for Higher Electric Rates at This Time

The California Railroad Commission has authorized an increase of electric rates to the Pacific Gas & Electric Company, the Great Western Power Company and the City Electric Company. The order is of a temporary character and is intended to provide the companies with sufficient revenue to safeguard their service to the public and to protect their financial status during the war emergency. At a later date the commission will continue hearings and at that time will make a final decision establishing permanent electric rates for these companies. The order is intended to provide the company with sufficient additional revenue to reimburse it for extraordinary increases in operating expenses, as a result of emergency conditions.

Among the factors contributing to the necessity for increased electric rates at this time are the following:

1. Higher prices of materials and higher wages paid to employees to meet the increased cost of living and to equalize wages paid in competitive industries.

2. Period of water shortage, resulting in substantial reduction in the amount of hydroelectric power available, and the consequent necessity for a greatly increased production of electricity in steam-power plants using fuel oil.

3. Increases in the price of fuel oil, which has more than doubled in the last two years. This in itself would increase the cost of electric power during a normal year, but during a year of reduced hydroelectric supply further adds to operating costs on account of the greater consumption of oil.

4. A curtailment in the use of electricity for lighting purposes and a resulting reduction of revenue on account of the daylight-saving act.

5. The necessity for the maintenance of the financial status of public utilities during the war period in order that they may obtain funds necessary to continue expansion of facilities.

Before raising the rates to consumers the commission by a sweeping order has removed all discriminations in rates paid by consumers which have existed on account of competition in the large cities and on account of old contract rates. This will place all consumers who have heretofore enjoyed special rates on a par with other consumers, and in the future all consumers will pay schedule rates and in addition the surcharges fixed in the order

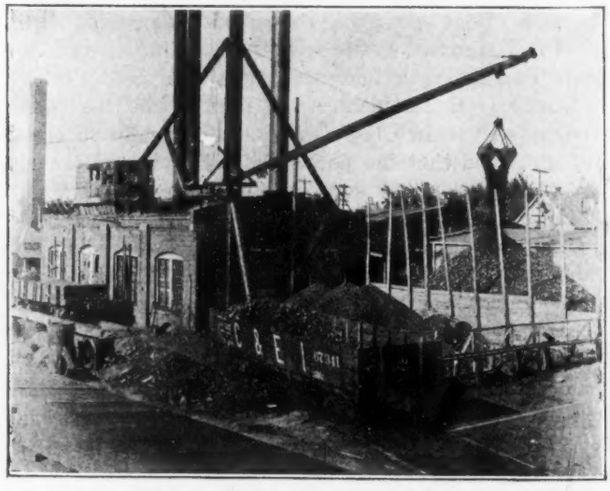
The Pacific Gas & Electric Company is authorized to add a surcharge of 1 cent a kilowatt-hour on all energy used for lighting purposes, and a surcharge of 0.2 cent a kilowatt-hour on all energy sold for power purposes. The bills for state department, county and municipal lighting and power, including street-lighting rates, will be raised 10 per cent. Energy sold to electric railways and to other electric companies at wholesale is raised 0.1 cent a kilowatt-hour. These increases, together with the additional revenue provided by placing special consumers on regular schedules, will provide the Pacific Gas & Electric Company with over $2,000,000 more revenue than was obtained from existing rates. So great have been the increases in operating expenses, however, that in spite of these increases and the increases in gas rates granted by the commission last month, the net income of the company will be $500,000 less than was earned during 1916 before the increased operating expenses occurred.

Very large power consumers that have special contracts which are outside of the scope of regular rate schedules have had their rates increased only by the 0.2 cent power surcharge. The contracts will remain as rates for these classes of service until the final adjustment of rates is made in the future.

The Great Western Power Company and the City Electric Company have been likewise ordered to remove all discriminations between consumers and to place all consumers on filed rate schedules except those special contracts to which no rate schedule applies. The lighting rates of these companies have been increased 1 cent a kilowatt-hour, and the power rates have been increased 0.2 cent a kilowatt-hour. No rate increases were allowed the Great Western Company or the City Electric Company for power sold for municipal street lighting, for electric railways served and to other public utilities for power at wholesale.

Urging Coal Storage in Indiana

An unusual but practical coal-handling outfit is a stiff-leg derrick mounted on top of power house. This illustration is sent, with a booklet on "Storage of Indiana Coal for Steam Purposes," by the Federal Fuel Administration for Indiana to all Indiana utilities. In an accompanying letter Evans Woollen, Indiana Fuel Administrator, says: "Should a shortage of coal exist next winter, as now seems probable, the state administration will not indiscriminately help you to procure coal because you are a public utility but will



carefully scrutinize applications for assistance. This administration will require you to show that you took all reasonable precautions to avoid a shortage."

Associations and Societies

The Directory of Electrical Associations, which is regularly printed in the first issue of each month, appears on page 239 of this number

Dixie Club.—This association, composed of Southern jobbers, met at Atlantic Beach, Fla., on July 22 and 23.

Association of Electrical Dealers and Contractors.—The national association has decided upon Milwaukee as the convention city of 1919.

Engineers' Club of Philadelphia.—As begun on July 16, a regular feature of the club will be a "Tuesday address luncheon." Well-known speakers will address the club on up-to-the-minute subjects. H. A. Stockly is secretary.

Jovian Electric League.—The annual convention of the Jovian Order will assemble at Dallas, Tex., some time in October. Jupiter Strickland has announced the committees to have charge of the Dallas meeting, and a complete program will be forthcoming in about a month.

Southwestern Electrical and Gas Association.—In place of the regular annual conventions this association has decided to hold quarterly meetings to be rotated between Houston, San Antonio and Dallas. This plan will permit the discussion of problems developing from rapidly changing war conditions more nearly as they arise. The first of these quarterly meetings was held at Dallas, July 19, with general program as follows: The sections (light and power, street and interurban railway, and gas) met in the morning separately, each under its chairman, to discuss matters of particular interest to the members. All sections assembled for a get-together luncheon at noon. In the afternoon a general session was addressed by the president of the association on matters concerning practically all utilities in the state. The general secretary's report was also read. All of the meetings are executive. The secretary of the association is H. S. Cooper, 405 Slaughter Building, Dallas, Tex.

Association of Iron and Steel Electrical Engineers.—As announced before, the twelfth annual convention of the association has been scheduled for Sept. 9-14, to be held at the Southern Hotel, Baltimore, Md. The tentative program of papers to be presented is as follows: "Methods of Education for Electrical Employees of Iron and Steel Mills," prepared by the educational committee; "Remote-Controlled Substations," by W. T. Snyder; "Automatic Engine Stops," by Walter Greenwood; "Standardization of the Rating of Large Steel-Mill Motors," by K. A. Pauly; "Practical Method of Selecting Carbon Brushes," by Alfred Mullhaupt, Jr.; "Bridge Motors for Cranes," by R. H. McLain; "Condensers and Condensing Engineering Practice," by D. D. Pendleton; "Roller Bearings for Cranes," by P. B. Liebermann; "Installation and Operation of Auxiliary Drives," by J. D. Wright; "High-Tension Installation Under Severe Conditions," by James Farrington; "Electrically Driven Mills, Showing Tonnages, Costs, etc.," by J. T. Sturtevant, and "Sixty Cycles Versus Twenty-five Cycles for Steel Mills," by J. E. Fries.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Expert Opinion.—In an action under the "death act" for death by electric shock, the testimony of defendant's former lineman, in answer to the question whether in his opinion it would be possible for the primary wire to jump over on certain bare places, that it would be possible under certain conditions, was admissible; for usually a subject cannot be developed by one question and answer, the Supreme Court of Michigan held in Brabon versus Gladwin Light & Power Company (167 N. W. 1024).

Right of Insurance Company to Collect Insurance for Employer Under Compensation Act.—Neither section 6, part 2, of the workmen's compensation act, providing that the insurance associations may recover indemnity from other persons who would have been liable to the insured employee, nor any other part of the act, in express terms or by implication, confers authority upon the insurer to reimburse himself for compensation paid to an injured employee as against a third person through whose negligence the injury occurred, or to be subrogated to the rights of the beneficiary as against such third person, the Court of Civil Appeals of Texas held (203 S. W. 1115) in Southern Surety Company versus Houston Lighting & Power Company.

Filing of Power Location.—A power company that files its map of water-power location first has the prior right to such location, a paper being deemed to be filed within the meaning of the law when it is delivered for that purpose to the proper officer and received by him, and it is not necessary that it shall be indorsed as having been so filed, the "file" mark being evidence but not essential, according to the Supreme Court of North Carolina in Carolina-Tennessee Power Company versus Hiawassee River Power Company (96 S. E. 99). A statute granting a charter to an electric power company cannot be attacked in a suit for an injunction against the purchase of land by another power company on the ground that the thirty days' notice required by law for the passage of private laws has not been given. The legislature may grant a power of eminent domain to one public service corporation, such as an electric power company, without granting the power to other public service corporations of the same class.

Assumption of Risk.—Notice of railroad company to employees to avoid high-voltage wires and stating that they assumed the risk thereof, though signed and read by an employee, did not change the rules of law governing assumption of risk, since it was not a contract, and, even if so, it had no force because signed after the original employment and in any event contrary to public policy in so far as it relieved the company from liability for its own negligence, the New York Supreme Court held (170 N. Y. S. 697). Risk of negligence of fellow employee in turning on current in high-voltage wire without warning, producing an unsafe place to work, may be assumed under the federal employers' liability act, unless the place was rendered unsafe by consequence of the negligence of the employer.

Condemnation of Water Power.—On certiorari by the owners of water rights to review a judgment of condemnation in favor of a power company, the function of the Supreme Court is limited to a finding of the reasonable practicability, necessity and public use of the projected scheme, the Supreme Court of Washington held (173 P. 192). The law requires, in order to condemn property, that the enterprise be for a public use, that the public interests require its prosecution, and that the land or property is required and necessary for the enterprise. In a power company's action to condemn water rights, the court's findings that a city granted the company a franchise in order that its inhabitants might be provided with electrical power for various uses, etc., that the city and its inhabitants depended on the power company to supply power and water, that the company's present plant was insufficient to meet the demands of a growing population, and that the company was proceeding to condemn in aid of its franchise, was sufficient to satisfy Rem. Code 1915, 925, requiring that the enterprise be public, be required in the public interest, and that the land or property sought to be condemned is necessary, the court not being obliged to find in bare words that the contemplated use is a public use, but merely to find facts from which the legal conclusion can be drawn. The mere fact that an electrical company was a riparian owner on a stream gave it no right to divert the waters, and, in the absence of a showing of intention so to do, of present acquisition of a right to divert the water, and of a way to divert and carry it, the electrical company was not entitled to compensation for deprivation of such use of the water when a power company condemned rights in the stream.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Deposit for Municipal Plant Meters.—An ordinance was passed recently by the commissioners of Owensboro, Ky., requiring a deposit of $2 with the municipal lighting plant before meters will be installed for patrons who do not own the property in which they live.

Rate Increase in Texas.—The Brush Electric Company, Galveston, Tex., is the latest Cities Service Company subsidiary granted an increase in rates. This rate increase became effective on July 1 and, it is estimated, will add about $45,000 annually to the net earnings under present conditions.

Demand for Power in Seattle.—Recently the Seattle municipal plant has rejected applications from large industries for approximately 5400 kw., according to a statement made by Superintendent of Lighting J. D. Ross. "This means that the 12,000 kw. of the new unit of the Lake Union plant is already exhausted," said Ross. "In the last six months we have signed contracts with local industries to furnish 14,784 kw. connected load, or 11,116 kw. maximum load."

Conservation in Refrigerators.—On account of the shortage in the supply of sheet steel and in order to meet increased needs of the government for certain other materials, the war service committee of the refrigerator manufacturers of the United States has been in conference with representatives of the War Industries Board to work out a program of conservation and substitution of materials. The committee report of a plan to eliminate various sizes and styles of refrigerators for the purpose of saving not only materials but labor and capital as well will be submitted soon to the conservation division of the War Industries Board.

Patent Office Needs Examiners.—There is a need for technically trained persons for the examining corps of the Patent Office. Men or women are desired who have a scientific education, particularly in higher mathematics, chemistry, physics and French or German and who are not subject to the draft for military service. Engineering or teaching experience in addition to the above is valued. The entrance salary is $1,500. Examinations for the position of assistant examiner are held frequently by the Civil Service Commission at many points in the United States. One is announced for Aug. 21 and 22, 1918. Details of the examination, places of holding the same, etc., may be had upon application to the Civil Service Commission, Washington, or to the Patent Office.

War Training for Mechanics.—The War Department committee on education and special training reports that success seems sure to attend a plan just put into effect to train mechanics in 150 institutions, such as trade schools, technical high schools, colleges, etc., with which is fitted in a course of instruction on the war aims of the United States and those of other countries, including the Teutonic empires, so that the men being trained may not only be able to fight behind the lines with their hands in matters of mechanics but be able to fight with their brains as well, by being able to know what they are fighting for. In the work of "training mechanics and developing their morale," of which C. R. Dooley is in charge as educational director of special training, the plan being worked out is to give enlisted men an eight weeks' course in mechanical training.

Loan to New Orleans Railway & Light Company.—The United States War Finance Corporation has agreed to lend the New Orleans Railway & Light Company $1,000,000 to reimburse the company for necessary expenditures, according to a letter of D. D. Curran, president of the company, addressed to holders of the two-year gold debentures which matured June 1 last. The Finance Corporation has stipulated that before the money shall be available the $4,000,000 outstanding debentures must be deposited under the company extension agreement and the success of the extension must be assured. Under the company's plan for the extension of these debentures, which was submitted to noteholders the middle of June, they were urged to deposit their holdings and receive in exchange a new one-year 7 per cent note, due June 1, 1919, callable at 100 and interest on thirty days' notice. According to Mr. Curran, more than 50 per cent of the debentures have been deposited.

Heavy Increases in War Taxes Proposed.—Heavy increases in war taxes with an excess profits tax as high as 80 per cent are proposed by a special committee on financing the war of the Chamber of Commerce of the United States in a report just sent out to the chamber's membership for a referendum vote. Repeating earlier declarations against special profits arising out of the war, emphasizing anew the necessity of economy and elimination of waste and extravagance, and quoting the committee's statement of last year regarding the advantages of heavy taxation in war time, the report presents eleven specific recommendations. The special committee is composed of John V. Farwell, chairman, Chicago; Edward A. Filene, Boston; P. W. Goebel, Kansas City, Kan.; John H. Gray, Minneapolis; Edmund D. Hulbert, Chicago; Stoddard Jess, Los Angeles; Hugh McK. Landon, Indianapolis; J. Lawrence Laughlin, Chicago; Robert F. Maddox, Atlanta; J. K. Orr, Atlanta; John T. Scott, Houston; Oliver M. W. Sprague, Cambridge, Mass., and Jesse I. Straus, New York.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Discontinuing Unprofitable Heating Service.—The Illinois Public Service Commission holds, in a decision affecting the Alton Gas & Electric Company, that where a steam-heating utility had been operating its plant at a loss, though rates were reasonable compared with the value of the service, and the company could not continue operation without rehabilitating its plant at a considerable expense and continue rendering service with a reconstructed plant at a reasonable rate and secure a fair return on its investment, the company should be authorized to discontinue rendering heating service.

Emergency Action.—Commissioner Hubbell of the New York Public Service Commission, First District, in an opinion affecting the Queens Borough Gas & Electric Company, says in part: "The commission is of the present opinion that a conclusion as to the merits of the present requests for temporary emergency relief can be reached without subjecting the company, the city or the commission to a 'present-cost' appraisal. . . . Generally, however, where (1) no change in relations between classes of consumers or localities is concerned; (2) the increase is asked for to cover only a temporary and emergency period, approximating the duration of the war or less, and (3) the increase is asked for to cover only the elimination of a current deficit in operating expenses, or, at most, the continued earning of some part of the fair and reasonable return ordinarily earned by the particular company in normal times, it is not believed that the commission need enter upon a regular rate proceeding with a reappraisal of the corporate property. Except where substantial reason appears for belief that a public utility company is currently earning more than a reasonable return upon its investment outlay, the commission is of the opinion that it may as well refrain from conducting rate cases in the usual formal fashion during the war and may devote itself to ascertainment of the relief necessary to be granted for the war period to prevent the breaking down of public utility service and lasting detriment to public utility property. Except where substantial reason for a contrary course appears, the commission is of the opinion that it need not, in awarding emergency relief for the limited period, inquire fully into the normal valuation of the corporate property or try to ascertain whether the existing rates have ordinarily yielded more or less than a reasonable return upon that value."

R. E. Bowen has been appointed engineer of the power station of the Little Rock (Ark.) Railway & Electric Company to succeed A. W. Russell.

C. J. Schultz has been promoted to be superintendent of the Bernardsville territory of the New Jersey Power & Light Company, succeeding John MacLean, resigned.

E. F. Neal, for many years chief electrical inspector for the city of Seattle, has resigned to take the position of assistant manager of the Standard Electric Company, Seattle.

John M. Drabelle, who has been electrical engineer for the Iowa Railway & Light Company of Cedar Rapids, has been appointed, effective Aug. 1, mechanical and electrical engineer of the company's entire system.

F. W. Laas, chief engineer of the Iowa Railway & Light Company, the Iowa Electric Company and the Iowa Falls Electric Company of Cedar Rapids, Iowa, has resigned his position to become superintendent of power for the Western Light & Power Company at Boulder, Col.

H. L. Nichols, manager of the Minnesota Gas & Electric Company, Albert Lea, Minn., and the River Falls Power Company, Hastings, Minn., has been selected as captain of the Red Cross canteen service for the Albert Lea canteen station of the Northern Division. Mr. Nichols was also county chairman for Freeborn County of the Red Cross second war fund campaign.

William C. Lounsbury has recently been appointed general manager of the Superior (Wis.) Water, Light & Power Company. He has been general superintendent for a number of years. He is a member of a number of technical societies and is at present vice-president of the Wisconsin Electrical Association. Mr. Lounsbury was born thirty-eight years ago in Brooklyn, N. Y., and is a graduate of the Massachusetts Institute of Technology. His promotion is the result of twelve years' work in the Superior company.

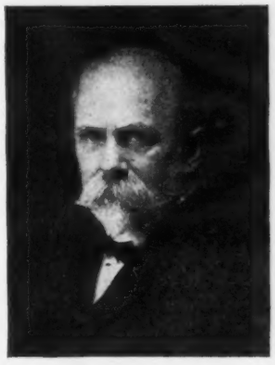
C. D. Flanigen, the new president of the Southeastern Section of the National Electric Light Association, is president and general manager of the Athens (Ga.) Railway & Electric Company. He was born in Philadelphia and was graduated from the Polytechnic College of the State of Pennsylvania with the degree of B.M.E. It was some years later that he entered the utility field. In 1883 he became manager of the Athens Gas Company, continuing in that capacity until 1890, when he became engineer for a development company and business manager of the Athens *Daily Banner* until 1894. Since that time he has advanced from superintendent to his present position with the Athens Railway & Electric Company. Mr. Flanigen has, in addition, taken a wide interest in local affairs, being vice-president of the Commercial Bank of Athens and having been for two terms, 1915 and 1916, president of the Chamber of Commerce.

Men of the Industry

Changes in Personnel and Position— Biographical Notes

Robert A. Bachman, for many years connected with Thomas A. Edison as vice-president and general manager of the Edison Storage Battery Company, has resigned in order to devote more time to his personal affairs.

George A. Hoadley, president-elect of the Illuminating Engineering Society, was born Dec. 2, 1848, at Sheffield, Mass. He was graduated from Union College, Schenectady, in 1874, with degrees from both the scientific and civil engineering courses. Until 1888 he was principal of the high schools in Argyle, N. Y., Fort Edward, N. Y., Florence, Mass., and Northampton, Mass., when he became



G. A. HOADLEY

head of the department of physics in Swarthmore College. From 1894 to 1914 he was vice-president of Swarthmore College, then retiring from active college work. Mr. Hoadley is the author of textbooks on physics, the latest having been published in 1913 under the title "Essentials of Physics." He is a charter member and fellow of the American Physical Society, a fellow of the American Association for the Advancement of Science, associate member of the American Institute of Electrical Engineers, having been chairman of the Philadelphia Section for one year, and in addition is a member of the board of managers of the Franklin Institute. He was chairman of the Philadelphia Section of the Illuminating Engineering Society in 1913 and represented that section in the council of the society as vice-president for the following two years. At the present time Mr. Hoadley is serving the Franklin Institute as acting secretary, on account of the absence of the secretary, Major R. B. Owens, in active military service overseas.

W. H. Harland has been appointed senior electrical engineer of the eastern district, Bureau of Valuation of the Interstate Commerce Commission, to succeed Milan V. Ayres, resigned to accept an appointment as major in the National Army. Mr. Harland will be in immediate charge of the electrical, signal, and telephone and telegraph branches.

Milan V. Ayres has resigned as senior electrical engineer for the eastern district, Bureau of Valuation of the Interstate Commerce Commission, to accept an appointment as major in the National Army. Mr. Ayres was born in Kansas in 1875 and at the age of twenty-three was graduated from the electrical department of the Massachusetts Institute of Technology. He first entered the employ of the General Electric Company at Schenectady in the testing department. In 1903 he became electrical and mechanical engineer for the Boston & Worcester Street Railway, South Framingham, Mass., continuing in that position until July, 1911, when he became assistant to the general manager of the Rockland Light & Power Company, Nyack, N. Y. In November of the same year he resigned to become chief engineer of the Mobile (Ala.) Light & Railroad Company. The following year he went with Ford, Bacon & Davis, consulting engineers, New York City, where he stayed until he became connected with the Interstate Commerce Commission in the spring of 1914.

Obituary

G. A. Goodnow, vice-president of the Chicago, Milwaukee & St. Paul Railway Company, died July 27 after a brief illness at Seattle, Wash. He was a prominent figure in the electrification program of that road.

Lieut. Warren Harries, youngest son of General George H. Harries, president of the Louisville Gas & Electric Company and vice-president of H. M. Byllesby & Company, according to a Paris dispatch, was killed in an automobile accident on July 25 in a provincial French city, where he was on duty. General Harries at the present time is serving in France in the American army.

Charles Allis, aged sixty-five, died in Milwaukee, Wis., July 22 of pneumonia following an operation. Mr. Allis was the first president of the reorganized Allis-Chalmers Company and at the time of his death was president of the Chicago Belting Company, trustee and member of the executive committee of the Northwestern Mutual Life Insurance Company and a director of the First National Bank and First Trust Company of Milwaukee. He was the second son of the late Edward P. Allis, founder of the E. P. Allis Company. Of late he had given most of his time to the Milwaukee County Council of Defense. He is survived by his widow.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

NEW SYSTEM ADOPTED FOR GOVERNMENT BUYING

Provides for Review of All Contracts by Control Boards, Centralizing of Purchases and Standardizing of Contracts

In connection with the method of purchasing supplies by the government the War Department authorizes the following statement:

With the coöperation of the Department of Justice, the War Department has nearly completed a system of control designed to protect the government in the procurement of all war materials. This system, in part, was put in operation under the direction of the General Staff about six weeks ago.

The new system provides for a review of every contract by boards of control, the centralizing of purchases, the standardization of contract clauses, a daily fiscal survey and provisions for public information on War Department needs.

About May 1, 1918, under instructions of the Secretary of War, a new division of the General Staff began to supervise the policy and practice of War Department purchases. The new division has arranged to centralize the purchase of commodities falling within the same classification in the hands of one bureau, so that now, for instance, one bureau instead of five, as heretofore, purchases all leather goods for the whole army and for hardware and all the usual trade classification of materials. There have been set up in each bureau boards of awards which are the ultimate authority on awards of all important contracts.

More than six weeks ago a committee composed of officers and civilians whose duty has been to prepare the tens of thousands of contracts of the War Department began an intensive study of every contract clause and policy in every agency of the War Department in an endeavor to prescribe in the light of more than a year's experience with war conditions the form of contract clauses that would best safeguard the interests of the government, with a view to prescribing for instant use well-considered and practice-proved forms for every conceivable circumstance of purchase. This committee is about ready to make its report.

On June 1 the General Staff ordered that, except in cases of immediate necessity, no contracts should be made with sales agents and that all War Department procurements should be negotiated either with the manufacturer or with recognized jobbers carrying the stocks on hand from which they proposed to supply the army.

LABOR DECISION MUST BE PUT IN EFFECT TO GET REHEARING

War Labor Policies Board Conferring with Unionized Labor and with Industry Regarding the Standardization of Wages

The National War Labor Board authorizes the following:

"The National War Labor Board has refused an appeal from a group of employing companies in Waynesboro, Pa., for a review of the board's recent decision in the controversy between the employers and workers in eight metal manufacturing plants in that city. The employers were told to put the decision into effect and that until they did so the board would not hear them.

"The decision of the board granted a general increase in wages to all of the workers, 3000 in number, and ordered that a system of collective bargaining be established and that an administrator be sent to see that the award was enforced. This representative of the board, Stiles P. Jones, has reported that the men are prepared to coöperate with him in every way. The employers, however, complained against the award on the ground that it was unworkable, opposing in particular that clause in which 40 cents was fixed as the minimum hourly wage to be paid to any employee in any classification, including the common laborer. They refused to meet with representatives of the men to develop a plan for giving effect to the award. Mr. Jones reported also that the situation has led to a feeling of unrest among the men that threatens to culminate in a repetition of the strike which brought the case first to the attention of the board.

"Upon hearing the report, Loyal A. Osborn, vice-president of the Westinghouse Electric & Manufacturing Company, made the following motion, which was unanimously adopted:

"'I move that it is the sense of the board that, inasmuch as the manufacturers in Waynesboro agreed to abide by the decision of the board, and the decision having been made, we expect the decision to be put into effect. We are not willing to give any further hearings in the matter pending the putting into operation of the decision.'"

A later announcement from the board on wages states:

"For several days the War Labor Policies Board has been conferring with representatives of union labor and with representatives of industrial management concerning the national standardization of wages. In seeking standardization the precedents of unionized industry are being followed."

REPLACING CARBON AND "GEM" WITH TUNGSTEN LAMPS

Gradual Progress Toward Change, Which Is a Fuel-Saving Measure, Is Essential if Serious Lamp Shortage Is to Be Avoided

Before the war Germany made annually about 100,000,000 lamps. Of these she exported 60,000,000. In addition to this she exported 60,000,000 bulbs. When the war started the demand for these 60,000,000 lamps and 60,000,000 additional bulbs came upon the lamp manufacturers of the United States. It soon developed that the manufacture of bulbs was the crux of the entire situation. Steps were therefore taken to increase the production of glass bulbs to a point where production would equal demand. Up to this point no attention was given to guiding the lamp production along lines of fuel conservation. Demand was the determining factor.

Now, however, as the necessity for conserving coal has become more acute, it has been suggested that substitution of tungsten lamps for carbon and "gem" lamps can be undertaken as a fuel-saving measure. Data on the subject worked out by lamp manufacturers indicate that 17 per cent of all fuel burned to produce incandescent lighting is consumed in operating carbon and "gem" lamps. Obviously to secure the same amount of light by the use of tungsten lamps instead of these carbon and "gem" lamps would require the burning of considerable less coal. Thus the question arises whether it is or is not possible to replace all carbon and "gem" lamps with tungsten-filament lamps.

Considering only the utilization of the lamps, it will be apparent that the change could be made, with few exceptions. There are a few classes of very rough service in which tungsten lamps do not give long enough life. The

manufacturer's problem, however, is a different matter. It is estimated that it would require the entire output of all American lamp factories for two years to replace all of the carbon and "gem" lamps now operating. If, therefore, the Fuel Administration or other governmental authority were to require the sudden replacement of all carbon and "gem" lamps, the first thing to happen would be an incandescent lamp shortage.

It is entirely within reason, however, to go about replacement of the less efficient lamps gradually. The manufacturers claim that during the coming season it would be possible to replace with tungsten lamps all carbon and "gem" lamps which burn out. Again, it appears that the manufacture of glass bulbs is the limiting factor. It would be possible to replace the burned out carbon and "gem" lamps with tungsten lamps only because bulbs which were originally intended to become carbon and "gem" lamps could be filled with tungsten filaments. It is stated authoritatively, however, that the only way to make better progress than this is for the government to return to the glass factories some of the skilled workers who have been called to active military service.

It is thought to be unlikely, in face of these facts, that the government will take action requiring wholesale replacement of inefficient lamps. It is expected, however, that some plan of gradual replacement will be worked out.

METAL MARKET SITUATION

Price of Copper Again Under Discussion—Conferences with Government Board Next Week

As Aug. 7 is close at hand, a further increase in the price of copper is being generally discussed. On that date the smaller producers of the metal, whose costs are higher than the average, may ask the War Industries Board to place the figure as high as 30 cents a pound, though 27.50 cents may be settled upon instead of 26 cents, the present price. A great many consumers, particularly in the electrical field, believed 23 cents, the former price, was quite high enough and were opposed to a change. Reports are that buyers are placing orders at the current rate deliverable prior to Aug. 15, when whatever price is decided upon will go into effect.

Selling agents, as heretofore, are supplying only a small part of the metal requested, as the government requirements have taken practically the entire amount available. It is significant that there are no large quantities of copper to be had for delivery before Aug. 15. There is a strong feeling that should the War Industries Board again change the fixed price manufacturers of brass and other products made of copper will make a request that the new quotation be established for as long a period as possible

In a year tin has advanced over 100 per cent. The supply is not ample. Lead rules strong, influenced by the scarcity of offerings. In the other metals inquiry is very quiet and price changes of no moment.

NEW YORK METAL MARKET PRICES

	July 22	July 29
Copper:	£ s d	£ s d
London, standard spot	122 0 0	122 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Govt. price 26.00	Govt. price 26.00
Electrolytic	Govt. price 26.00	Govt. price 26.00
Casting	Govt. price 26.00	Govt. price 26.00
Wire base	29.75	29.25
Lead, trust price	8.05	8.05
Antimony	13.12½ to 13.37½	13.00 to 13.25
Nickel, ingot	40.00	40.00
Sheet zinc, f.o.b. smelter	Govt. price 15.00	Govt. price 15.00
Spelter, spot	8.65 to 8.75	8.35 to 8.50
Tin, Chinese *	$1.00	94
Aluminum, 98 to 99 per cent.	Govt price †33.00	Govt. price †33.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	23.50 to 24.00	23.50 to 24.50
Brass, heavy	14.50 to 15.00	14.50 to 15.00
Brass, light	12.00 to 12.25	11.50 to 12.25
Lead, heavy	7.12½ to 7.50	7.12½ to 7.50
Zinc, old scrap	6.50 to 6.75	5.50 to 5.75

* No Straits offering. † In 50-ton lots or more; carload, 33.10 cents per lb.; 1-ton to 14-ton lots, 33.20 cents per lb.

THE WEEK
IN TRADE

A POSSIBLE shortage and the difficulty of obtaining adequate supplies of staple electrical lines are causing concern in all sections of the country. Priority orders are being required on so many items that the exception is notable. Government restrictions on steel for the lesser essentials are interfering to an appreciable extent with the filling of commercial requirements.

Prices on a number of articles have again gone up, and these advances are becoming so frequent that very little, if any, comment is occasioned by the regularity with which the revisions are announced. There is no abatement of business, and heavy sales are predicted for the fall.

Washing machines are in strong demand everywhere. Sewing machines and vacuum cleaners are also selling very satisfactorily. The stock of fans is being rapidly depleted in certain of the larger sizes by the arrival of seasonable weather. Some sizes of lamps and all sizes of conduit are scarce.

Labor shortage East and West is a source of constant anxiety as well as the cause of curtailment in factory production. The first 600 plants to report their labor requirements to the Federal Employment Service asked for approximately 25,000 laborers in July and about 40,000 this month; the 25,000 wanted in July represent an actual shortage.

NEW YORK

With nearly every line of business finding it more and more difficult to obtain goods against future requirements, the electrical trade in this section is also beginning to feel the pinch. It has been apparent to even the casual observer for some time that such a situation existed. The majority of jobbers, dealers and contractors have, with few exceptions, denied that there was any difficulty in obtaining goods. Now it is frankly admitted that shortages in many staples exist, and their replacement is uncertain. In fact, conditions are such that nearly all merchandise, no matter what, is hard to get. During the past week several manufacturers have notified jobbers that unless they and their dealers sign up the requirements at once for everything of steel and iron, orders will not be filled. These advance pledges enable the producer to obtain the material from the mills on a priority preference.

Business is excellent, with commercial trade very light as compared with government transactions, which are being carried along in many instances on a huge scale. Prices are firm, with a tendency to harden, and a number of items of importance are on new high levels. Shortage of labor is rendering impracticable full capacity operation of factories. Dealers in new and second-hand machinery find a ready sale for all available stock.

Collections are reported fair to prompt and on the whole very satisfactory. The outstanding feature in this vicinity of late is the further restriction of credits.

ELECTRIC RANGES.—A heavy sale of ranges is anticipated this fall. One distributer has placed an order for two carloads in excess of last year's requirements, for October delivery.

GLASS INSULATORS.—Prices were advanced up 5 per cent on July 1 by an Eastern factory.

DOMESTIC APPLIANCES.—A Western manufacturer of sewing-machine motors advanced prices on July 1 on his entire line to the extent of $1 each on certain models.

POLE-LINE HARDWARE.—The government's requirements of steel are creating a shortage. On galvanized bolts and braces prices have gone up 10 per cent. One

large distributer suggests to jobbers that on all line hardware in warehouse a net profit of 10 per cent should be added. This has been applied to his own stock.

COLLECTIONS AND CREDITS.—Jobbers and manufacturers are following a policy of demanding shorter terms of credit and giving preference in sales to those who make prompt payment.

WOOD POLES.—Forty-foot chestnut poles that sold four months ago at $6.85 now command $9.85. It is difficult to get chestnut poles of this size, and about three or four carloads are the only stock a leading jobber has on hand. Cedar, red and white, is in pretty fair supply. It is easier to obtain cars for shipping in the West than in the East, though transportation conditions have greatly improved everywhere. A shipper has been trying to get two and three cars of poles to Eastern points, but they are several weeks behind. The new freight advance of 25 per cent is taken care of by adding 6 per cent per 100 lb. on poles.

STEEL STRAND.—Stranded wire for guying poles went up 2½ per cent on July 15.

LAMP GUARDS.—On July 1 prices of the Matthews line were increased 5 per cent.

LIGHTING FIXTURES.—The government is taking a lot of goods, running heavily on Brascolite fixtures. There has been no change in prices since June 1. One prominent concern stated that sales are better than a year ago.

SCHEDULE MATERIAL.—An order for 25,000 pieces, averaging in cost about $8,000, was declined by a jobber last week because delivery was required in three weeks. This was said to be impossible. A resale price giving an extra 10 per cent discount is expected on Schedule B.

SWITCHES.—Following an order from a jobber an Eastern manufacturer notified his customer as follows: "We shall be unable to make very prompt shipment of this material if it is for commercial use. If, however, this is for government work and you can favor us with a government requisition covering same it will greatly facilitate delivery." These notifications are getting to be the rule on orders of all kinds.

PORCELAINS.—Cleats, knobs and tubes were advanced 10 per cent.

BELLS AND GONGS.—A further increase in price was announced as effective July 26.

CHICAGO

Signs that industrial business will continue to be good in the Chicago territory are to be found everywhere. Nearly every issue of the daily papers carries announcement of some new factory being started or some real estate being purchased for this purpose. The unified traction plan, which now stands at a critical stage, may at any minute become a reality, bringing one step nearer the great construction program which it would necessarily entail. The appointment of a committee on power unification for Illinois this week is also looked upon as an omen favorable to the business of those who manufacture tie-line apparatus, as it is probable that the number of industrial plants which will be shut down in the coming months will exceed the usual number considerably. The jobbers' business in general has been good.

PORCELAIN.—Prices have advanced on some standard porcelain.

POLE-LINE HARDWARE.—There has been a slight advance in the Joslin line of pole-line hardware.

COPPER WIRE.—Rubber-covered copper wire and lamp cord still remain on the 34-cent base, and the weatherproof is now sold at 32 cents.

SCHEDULE MATERIAL.—Sales of schedule material are confined largely to industrial plants. The market here is good.

FANS.—While the weather has been extremely hot, a great volume of fan business has not materialized.

OIL FILTERS.—One Chicago manufacturer is in a position to make prompt deliveries on all of the more common sizes of oil filters.

WASHING MACHINES.—The washing-machine business in the territory continues to be in good volume. As indicative of the condition, one manufacturer, whose company is eleven years old and has sold about 300,000 machines, has stated that his business so far this year is some 300 per cent better than during the same period for 1917. His 1917 business was almost 100 per cent larger than his 1916 business.

SECOND-HAND MACHINERY.—Chicago second-hand electric machinery dealers are reported to have an unusually desirable and complete stock of machines. These dealers say, however, that this condition will not obtain for long, and regular customers have been advised to select quickly from this stock and order by wire, as the demand is greater than the supply. In the second-hand trade there is a large demand for good leather belting, and an appeal is being made for beltings free from rivets and rivet holes, not burned, oil-soaked, stretched on the edges or scarred. The offer second-hand machinery dealers are making is that if such belts are sent to them for examination they will make high cash offers and remit by return mail, with the understanding that they also return, freight or express charges prepaid, all belting rejected as not up to specifications. One company is offering 80 cents per pound and up, depending on the condition of the belting.

ATLANTA

The precipitation at Southeastern watersheds has been light and not in sufficient quantity to supply normal water-power requirements, and as a result of the continued drought the large power companies in this section are suffering. The Southern Power Company and the Georgia Railway & Power Company have asked some of their customers to discontinue the use of power temporarily, while the Central Georgia Transmission Company and the Columbus Power Company have arranged for power curtailment by their customers.

The new order of the Fuel Administration regarding "lightless nights" goes into effect this week, and while the amount of curtailment will be small it will tend to relieve those power companies that are now supplementing water power with steam power.

It has been announced that Fayetteville, N. C., has been selected as a site for an artillery camp. There is a rumor that a good portion of this camp will be made up from Anniston, Ala. Unconfirmed reports are out to the effect that Columbus, Ga., will be selected as a site for the firing school now at Fort Sill, Okla.

Investments in textiles and shipping are active this week. The George A. Fuller Company of New York City will construct piers and warehouses for the Quartermaster's Corps, costing $10,000,000. The Burger Steam Ways Company, Tampa, Fla., will expend $200,000 to increase present facilities. The Roger & Crawford Spinning Company, Lincolnton, N. C., will build a 10,000-spindle mill and use electric power.

BOSTON

Little change is to be seen in the volume of trade this week. Collections remain good, on the whole, and prices hold firm at previous levels. Stocks are substantial in most lines. Railroad conditions do not show much improvement, and deliveries are correspondingly handicapped. The trade in appliances is being well maintained. Plans have been announced for the further enlargement of army base facilities at Boston, and the war market seems to increase without limit. Labor conditions show some improvement, and employees at the Lynn plants of the General Electric Company who left without notification are now returning in considerable numbers. Factory stocks of electrical equipment used in industrial and war work are running low in general. The supply of raw materials to manufacturers is now governed almost exclusively by priority regulations, and the industry is rapidly getting adjusted to these unprecedented conditions. Credits are being watched closely, but there is no evidence of underlying instability.

WIRE AND CABLE.—Bare wire is being quoted at 28¾ cents base price and rubber-covered wire at a 34-cent base. Deliveries range from five to ten weeks, and little change is noted in these. About 75 per cent of the orders now being filled are for government work. The anticipated increase in street-railway wire purchases, following recent fare developments, has not yet materialized.

VACUUM CLEANERS.—Manufacturers are very busy filling orders, and in some cases desirable business has to be turned down for the present on account of lack of facilities for production. There is prospect of a price increase, according to a representative manufacturer. Factory stocks are very low. The jobbers report a falling off in the cleaner sales account, which however, is not likely to outlast the summer.

SWITCHES AND PANELS.—Manufacturers' stocks are very low. An enormous output is going into government work. More labor could be used to advantage if it could be obtained. The demand for standard and special equipments is very heavy. Raw material is in hand at the factories in reasonably good quantities.

FANS.—Seasonable weather has resulted in a heavy movement of fans to the ultimate consumer, but not enough to lower seriously the existing supplies in the warehouses. Some reordering of sizes sold out in the last few days of the hot weather is being cared for. The increased prices of the larger fans this year are unquestionably retarding retail purchases.

FLASHLAMPS.—A good business is being handled in connection with night watchmen's service in munition and other industrial plants doing war work. Stocks are somewhat below normal, prices remaining firm, and the military demand is not up to former levels.

MOTORS.—Apart from the handicaps of railroad congestion and embargoes the flow of motors into New England is being well maintained. The factories are speeding up to meet the demand in general better than formerly. Shipments are being quoted in some cases as low as three to five weeks from the factory. Stocks of single-phase motors up to 5 hp. are in good volume at Boston just now, and up to 10 hp. three-phase motors are fairly plentiful. Prices are steady and inquiries are coming in at a brisk rate.

WASHERS.—The demand is heavy, and it is no easy matter to build up a satisfactory stock at this time.

MINIATURE LAMPS.—Special lamps and miniatures are running short in the open market. The civilian trade has no conception of the magnitude of the government demand and is inclined to wonder at times why the supply of candelabra lamps and other shapes beyond the ordinary does not increase faster. Under present conditions the industry is fortunate to obtain the so-called bread-and-butter sizes in ample quantities for its needs.

SEATTLE

Seattle jobbers and dealers report no abatement in general business activity. The more optimistic predict that heavy sales are in prospect for the fall. Along domestic lines washing-machine sales were easily the leader. The total volume of sales was about the same as the previous week. Orders in Seattle for several vessels for the Emergency Fleet Corporation swelled the volume noticeably. Government buying for the Puget Sound Navy Yard and the cantonment in the Puget Sound district is very light. Power apparatus sales show no noticeable increase over the past month. Inquiries for power apparatus for lumber mills to be electrified have not culminated in orders; in fact, mill building in the Puget Sound territory is very limited, consisting mainly of extensions to existing plants and rebuilding plants destroyed by fire. The Gray's Harbor country and certain districts in Oregon report considerable activity in mill building, particularly in plants of medium capacity. Central-station buying shows no particular change over the last three or four months, consisting of staples, which move well. Central stations report the movement of electric ranges satisfactory, but the demand is not large. Strictly commercial business shows no decided change, the volumes maintaining the level established in the early spring.

The survey of housing facilities in Seattle shows that approximately 5000 residences must be built to meet imperative war housing needs. The Chamber of Commerce has appointed a committee to conduct an organized campaign to obtain pledges from corporations, firms and individuals for the immediate building of a definite number of houses within the next four months. Portland authorities state that the city has a serious housing problem to meet and steps will be taken immediately to meet the demand for housing employees. At the Standifer shipyards, Vancouver, Wash., it is proposed to erect immediately a 600-room hotel and 100 cottages.

The Pacific Power & Foundry Company of Portland, Ore., and Seattle, Wash., plans the immediate expenditure of $100,000 in extensions and betterments.

VACUUM CLEANERS.—The summer demand has kept up well, with the expectations of both jobbers and dealers realized. Indications are that the fall business will be comparatively heavy.

PORCELAIN.—During the past week the demand was rather light. However the demand fluctuates with orders from the shipyards and central stations. Stock is in fair condition and prices remain the same.

RUBBER-COVERED WIRE.—The demand is steady with no change in prices. Stocks have been maintained fairly well by advised ordering.

LAMPS.—It is exceptionally hard to obtain larger sizes, and the demand for these is heavy—shortage is expected to continue. Smaller and standard sizes are coming through nicely.

CONDUIT.—Pipe is still very hard to obtain with a constantly increasing demand from shipyards.

SAN FRANCISCO

From all sides come reports of excellent business, which soon will be augmented by even more ambitious plants. For instance, the already considerable plant of the Bethlehem Steel Company of San Francisco is to be doubled by the purchase of nearly fifty acres, giving excellent rail and water facilities. The great yard of the Pacific Coast Shipbuilding Company near Baypoint is near completion, and soon will follow the construction of necessary workmen's housing. The present Potrero yards of the Bethlehem Steel Company are to be fitted with a cafeteria to cost over $100,000. New schools for Oakland and San Francisco are announced. New United States government construction includes sixty-one cantonment buildings at Fort MacArthur, near San Pedro, costing $120,000.

CONDUIT.—Both black and sherardized or galvanized conduit and fittings took another advance of 10 per cent during the last two weeks.

WEATHERPROOF WIRE.—All sizes of weatherproof copper wire have just advanced 3½ cents a pound for Pacific Coast delivery in conformance with the new factory quotations. Deliveries are quite ample to take care of the local situation.

GALVANIZED-IRON WIRE.—A small advance of 1 cent per pound in price has just become effective. A feature of the last week was a large order for size 10 of B. B. galvanized-iron wire from the Northern California Power Company, aggregating 15,000 lb.

SCHEDULE MATERIAL.—Dealers, jobbers and manufacturers report a greatly increased demand for staple wiring devices, such as sockets, switches and cut-outs.

ELECTRICAL APPLIANCES.—Standard 6-lb. irons now list at $6 each, standard upright toasters with racks at $6.50 each, and all other small heating appliances, comprising electrical grills, percolators, disk stoves, air heaters, water heaters and the like, have advanced from 5 to 10 per cent. Manufacturers and jobbers report large sales of these devices prior to the advance. The present large stocks, coupled with present public apathy, means that vigorous fall campaigns will be made.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List Per 1000 ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	57.25
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	66.75

Twin-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	97.75
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	126.80

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	+20%
Coil to 1000 ft	5%
	No. 12 Solid
Less than coil	+20%
Coil to 1000 ft	5%

Twin-Conductor

	No. 14 Solid
Less than coil	$115.00 to $80.00
Coil to 1000 ft	80.00 to 75.00
	No. 12 Solid
Less than coil	+20%
Coil to 1000 ft	5%

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	12%
1/5 to std. pkg	20%
Std. pkg	44%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+20% to 12%
1/5 to std. pkg	List to 20%
Std. pkg	25% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.31	.32
Barrel lots	.28	.29

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.322	.332
Barrel lots	.292	.302

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
⅜	250	$5.00
½	250	7.50
⅝	100	10.00
¾	50	13.00
1	50	21.00
1¼	50	26.00
1½	25–50	35.00
2	25–50	45.00
2½	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
⅜-in. single strip	$75.00	$69.75
⅜-in. double strip	75.00	72.00
½-in. single strip	100.00	93.00
½-in. double strip	100.00	96.00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
⅜-in. single strip	$75.00	$64.25
⅜-in. double strip	78.75	71.25
½-in. single strip	100.00	85.00
½-in. double strip	105.00	95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
⅛	$0.05½	1	$0.25
¼	.06	1¼	.33
⅜	.09	1½	.40
½	.12	1¾	.47
⅝	.15	2	.55
¾	.18	2½	.65

NET PER 1000 FT.—NEW YORK

	Less Than $15 List	$15 to $60 List	$60 to $150 List
⅛-in.—	$55.00	$24.45	$21.50
¼-in.—	30.00	27.00	23.50

NET PER 1000 FT.—CHICAGO

	Less Than $15 List	$15 to $60 List	$60 to $150 List
⅛-in.—	$60.00	$30.00	$26.50
¼-in.—	$65.00	$32.50	$29.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 40

Size, In.	Conduit, List per Foot
¼	$0.08½
⅜	.08½
½	.08½
¾	.11½
1	.17
1¼	.23
1½	.27½
2	.37½
2½	.58½
3	.76½

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
¼	$0.05	$0.19
⅜	.06	.19
½	.07	.19
¾	.10	.25
1	.13	.37
1¼	.17	.45
1½	.21	.50
2	.28	1.10
2½	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb	12%	14%
2500 to 5000 lb	15%	17%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ to ½ In.	¾ to 3 In.
Less than 2500 lb	+5% to 1½%	+3% to 3½%
2500 to 5000 lb	+2% to 4½%	List to 6½%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$5.00
Discount	30%

CHICAGO

List price	$5.00 to $6.00
Discount	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	30%
1/5 to std. pkg	50%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	30%
1/5 to std. pkg	40% to 41%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	$5.00
1/5 to std. pkg.	4.50

Standard packages, 500. List, each $0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	$7.00
1/5 to std. pkg.	5.75

Standard packages, 500. List, each, $0.07

LAMPS, MAZDA

105 to 125 Volts

Regular, Clear:	Std. Pkg.	List, Each
10 to 40-watt—B	100	$0.30
60-watt—B	100	.35
100-watt—B	24	.70
75-watt—C	50	.70
100-watt—C	24	1.10
200-watt—C	24	2.20
300-watt—C	24	3.25
Round Bulbs, 3½-in., Frosted:		
15-watt—G 25	50	.53
25-watt—G 25	50	.55
40-watt—G 25	50	.55
Round Bulbs, 3¾-in., Frosted:		
60-watt—G 30	24	.77
Round Bulbs, 4½-in., Frosted:		
100-watt—G 35	24	1.10

DISCOUNT—NEW YORK

Less than std. pkg.	List
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	List
Std. pkg.	10%

LAMP CORD

Cotton Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$35.90
Coil to 1000 ft.	26.95

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30.00 to $35.00
Coil to 1000 ft.	25.00 to 26.00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$24.00

CHICAGO

Net per 100	$30.00

OUTLET BOXES

Nos.	List, Per 100
101—A, A1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200, S.E., 300, A.X., 1½, 4S	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S., 1½, 3 R	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	25%	20%
$10.00 to $50.00 list	42%	37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	40%	35%
$10.00 to $50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$38.00
1/5 to std. pkg.	19.00

Standard package, 2200. List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$15.80 to $24.15
1/5 to std. pkg.	14.80 to 21.00

Standard package, 2200. List per 1000, $20.00

PORCELAIN KNOBS

NEW YORK

Per 1000 Net	Std. Pkg. 3500 5½ N.C.—Solid Nail-it—N.C.	Std. Pkg. 4000 N.C.
Less than 1/5 std. pkg.	$20.00	$30.75
1/5 to std. pkg.	15.60	24.00

CHICAGO

Per 1000 Net.	Std. Pkg. 3500 5½ N.C.—Solid Nail-it— N.C.	Std. Pkg. 4000 N.C.
Less than 1/5 std. pkg.	$9.48 to $18.40	$30.75 to $36.80
1/5 to std. pkg.	$8.88 to $16.00	24.20 to 32.00

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
⅛-in. cap key and push sockets	500	$0.33
⅛-in. cap keyless socket	500	.30
⅛-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	8%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	List to 10%
1/5 std. pkg.	16⅔%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100 amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+5%
$10 to $25 list	11%
$25 to $50 list	14%
	Low Grade
Less than $10 list	5%
$10 to $25 list	16%
$15 to $50 list	24%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+15% to +5%
$10 to $25 list	List to 11%
$25 to $50 list	5% to 14%
	Low Grade
Less than $10 list	+5% to 5%
$10 to $25 list	8% to 16%
$25 to $50 list	16% to 24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single pole	250	$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	+ 10%
1/5 to std. pkg.	8%
Std. pkg.	25%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to list
1/5 to std. pkg.	List to 16⅔%
Std. pkg.	25%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	40%	30%
$2.00 to $10.00 list	50%	40%
$10.00 to $50.00 list	64%	52%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $2.00 list.	25% to 40%	15% to 30%
$2.00 to $10.00 list.	25% to 50%	15% to 40%
$10.00 to $50.00 list.	35% to 64%	25% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price	$6.00
Discount	30%

CHICAGO

List price	$5.50 to $6.00
Discount	25% to 30%

WIRE ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$.434
No. 18, full spools	.384

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.69
No. 18, full spools	.575

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$20.00	$15.00	$11.25
12	27.10	23.20	17.05
10	37.80	32.40	23.75
8	53.35	45.70	33.35
6	84.40	72 35	53.05

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$.....	$21.00	$.....	$16.00	$.....	$13.25
12	27.53–	28.70	23.86–	28.70	22.02–	24.50
10	33.02–	40.10	30.48–	40.10	27.44–	34.23
8	46.09–	56.50	42.54–	48.23	38.99–	41.34
6	61.30–	91.18	61.76–	77.84	52.18–	66.72

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	$38.40
25 to 50 lb.	36.40
50 to 100 lb.	32.40

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	$39.50 to $39.72
25 to 50 lb.	38.50 to 38.72
50 to 100 lb	37.50 to 37.72

NEW APPARATUS & APPLIANCES

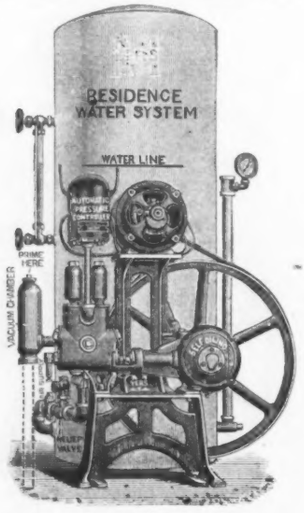
A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Alternating-Current Switches

Manually operated switches for starting small induction motors and protecting alternating-current light, power and individual motor circuits are now being manufactured by the Allen-Bradley Company, 495 Clinton Street, Milwaukee, Wis. The under-voltage release coil and mechanism on this switch are smaller than the coil and armature on the similar automatically operated switch. The switch contacts are of the copper-to-copper rolling type. Instantaneous or time-limit overload relays are mounted directly under the clapper switch. The time element of the overload relays may be adjusted so that the electrical equipment is not disconnected from the line with instantaneous fluctuations of load but is protected against serious overload. The instantaneous relays are of the hinged type and will not permit the starter to be closed when starting until the current has reduced to a predetermined value.

Self-Oiling Electric House Pump

For pumping water from shallow wells, cisterns, springs, lakes and other sources and forcing it into pressure tanks, open tanks for water supply for private residences, public places, etc., F. E. Myers & Brother, Ashland, Ohio, are manufacturing a self-oiling electric house pump. The pump is

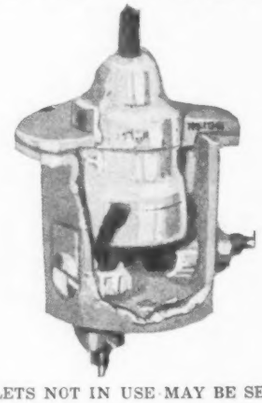


ELECTRIC HOUSE PUMP

driven by a 6-hp. direct-current or alternating-current motor through a simple power transmission with few working parts, these being fully inclosed and running in oil. The pump may be fitted with a 32-volt direct-current motor for use with a farm-lighting system. The operation is automatically controlled by the use of an automatic pressure controller, which, it is claimed, saves electricity, wear and tear on the pumps and time and labor in starting and stopping.

Floor Box

Where an adjustable box is unnecessary for a floor outlet or where the conduits are not over ½ in. (1.2 cm.) in diameter, a floor box placed upon the market by M. B. Austin & Company, Chicago, can be well used. Each box is drilled and tapped for 4½-in. (11.4-cm.) conduits, and plugs are supplied so that the outlets not in use can be hermetically sealed. Boxes are galvanized inside and outside. The cover, nozzle and flush plug are polished brass.

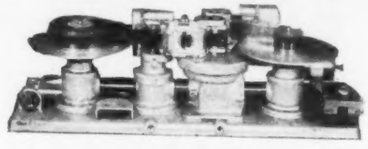


OUTLETS NOT IN USE MAY BE SEALED

Electric "Movie" for Show Windows

A new type of moving-picture machine for show windows or other display space has been brought out by the Attractograph Company, 220 West Forty-second Street, New York City. This machine displays pictures which can be readily seen in broad daylight as well as by night. One has been purchased by the government for forest service demonstration. Its operation is entirely automatic in all its functions. After the reel is projected it is automatically rewound and then displayed again, so that after the machine is arranged and started it will continuously operate for an indefinite period without any further attention.

The outfit consists of two separate parts, the moving-picture machine and the miniature theater in which the pictures are displayed. The moving-picture machine is operated by a standard-type Westinghouse universal motor, which will operate on either direct current or alternating current. Two horizontal disks carry the film, which passes in one direction for projection and in the opposite one for rewinding.



MOTION-PICTURE MACHINE APPROVED BY BOARD OF UNDERWRITERS

A 250-watt "mazda" stereopticon lamp, with concentrated filament, furnishes the light, which is automatically extinguished when the machine stops and during the process of rewinding. The machine is equipped with automatic safety switches, which stop the motion and put out the light in case of breakage of the film.

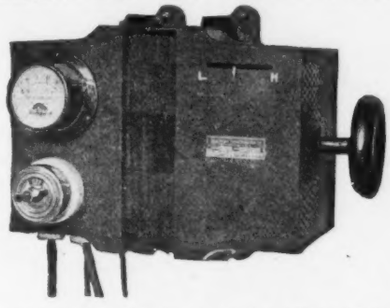
The moving-picture projector is placed about a foot from the miniature theater in which the picture is displayed so that the light enters an aperture in the base; here it strikes a mirror set at an angle of 45 deg. and is reflected upward upon a screen set on what would be termed a stage. Another 45-deg. mirror reflects an image of the screen, making the picture appear to the audience to come from a screen on the rear wall of the theater.

Standard non-inflammable films in lengths of 50 ft. to 500 ft. (15.2 m. to 152 m.) can be exhibited. This apparatus is approved by the National Board of Fire Underwriters.

Transformer for Motion-Picture Service

As shown in the accompanying illustration, the American Transformer Company, Newark, N. J., has developed a special type of transformer for motion-picture service in connection with incandescent lamps. The transformer is at the present time being marketed by the Precision Machine Company, 317 East Thirty-fourth Street, New York City. The control of the current in this transformer is obtained by means of a variable magnetic leakage path which permits a greater or lesser amount of the magnetic flux to pass between the primary and secondary coils, thus changing the secondary voltage. The adjustment is made by turning a knob placed at the right end of the transformer. An indicator in the slot

marked *L* and *H* shows approximately the range that the current can be increased or decreased. At the opposite end of the transformer the ammeter and switch are mounted. All connections of the transformer are therefore made at one end and cannot



STARTING SWITCH ALLOWS LAMP TO BE HEATED GRADUALLY

in any way interfere with the regulating device.

The regulating device is so constructed that it operates quietly and permits of adjusting the current to the exact value required. The starting switch is connected through a resistance to the primary winding so that at the starting point the voltage supplied to the lamp is only about half normal voltage. This permits the lamp to be heated gradually and prevents an excessive rush of current. The transformer is intended to be mounted on the wall within easy reach of the operator. The transformers are made in two sizes, one suitable for 600-watt lamps and the other for 1200-watt lamps.

Loom Fastener for Any Style Conduit Box

A fastener shaped in such a way that it will grip and hold firmly any size of non-metallic conduit is being manufactured by the Snover Electric Company of Toledo, Ohio. The manufacturers say that this fastener will not penetrate the tubing and tear the lining. The conduit cannot be drawn from the box when this fastener is in place because the greater the pull on the loom the greater the holding strength of the fastener. No tools are needed to install this device.

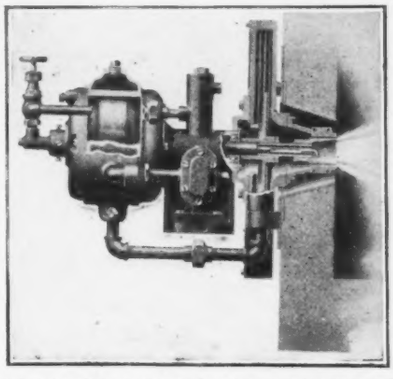
Motor-Driven Driller and Tapper

A multiple drilling head which houses four separate drilling spindles is the feature of a motor-driven drill press that is being manufactured by the Landau Machine & Drill Press Company, Inc., 19 West Forty-fourth Street, New York City. The multiple drilling head is composed of a stationary upper member rigidly affixed to the driller standard and a rotatable lower member which carries four drill spindles, each one having an independent means of adjustment for depth of feed. A collar and a handle serve to rotate the movable bonnet quickly and easily so that when one chuck has done its work a simple movement of the handle brings the next chuck into place. The entire machine occupies a floor space of approximately 12 in. by 28 in. (30 cm. by 66 cm.), and it is claimed that it will accomplish as much as a four-spindle drill press. The machine is operated by a motor of ¼ hp. and is arranged so that only one spindle operates at a time, the rest remaining idle until wanted

Compact Burner for Fuel Oil

One way to help prevent a recurrence of the fuel conditions of the past winter is to use fuel oil more extensively in those sections of the country where it can be easily and cheaply obtained. For successfully burning fuel oil the apparatus must be simple. Machinery to drive pumps, air blowers and gear boxes complicates the problem, entailing initial cost and heavy expense for upkeep. The fuel oil, moreover, must be perfectly atomized, and at the same time sufficient air must be introduced to get thorough combustion.

The foregoing factors have been taken into consideration in designing



OIL BURNER SUITABLE FOR FURNACES UP TO 500 HP.

the Ray oil atomizer. It consists of an open cup, lying horizontally and driven at 3450 revolutions per minute so as to force air at high velocity around the cup and in a direction away from the cup. By this method sufficient air is forced into the furnace to maintain proper compression and also direct the fire into the fire box. Since the air leaving the blower would have a tendency to turn in the same direction as the atomizer, causing the fire to be unsteady and throwing oil on all sides of the fire box, guide vanes have been inserted in a nozzle surrounding the atomizer, which direct the air from a revolving motion to a straight path.

The oil atomizer is driven by a Westinghouse totally inclosed motor having a hollow frame through which the fuel oil is allowed to pass continually. This lengthens the life of the motor by keeping it cool at all times and at the same time warms the oil somewhat before it it ignited. This arrangement also permits the use of the burner in a boiler room with a temperature so high that an ordinary open motor would overheat and burn out. Fuel oil as low as 14 gravity can be burned successfully, without smoke, soot or dirt, in all types of fire boxes, where high heat is needed, according to the manufacturer.

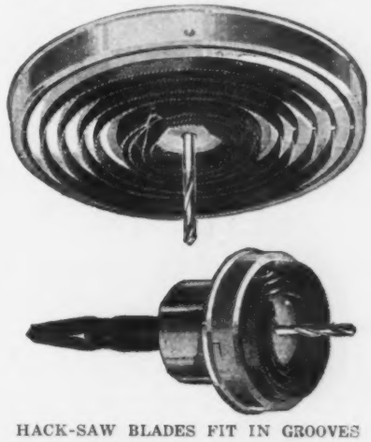
One man can supervise a large number of these oil burners, and they can be used in any furnace up to 500 hp. rating. The burner is made by the W. S. Ray Manufacturing Company, 220 Market Street, San Francisco, Cal.

Low-Voltage-Indicating Measuring Instruments

In the latest model of low-voltage and current instruments made by the American Ever Ready Works, Long Island City, N. Y., simple and strong construction has been well carried out to insure accuracy. Dead-beat movement of the pointer is obtained through the use of an aluminum vane, supported on hardened steel pivots, which moves in a partially closed air chamber. This allows the pointer to be governed by the smallest change of current flow. The sudden vibration of the car will not affect reading as the torque produced by the magnetic field is very high. Both of the new models are dust-proof and waterproof. The case diameter of these instruments is 2⅛ in., and the standard ranges are 15-0-15, 20-0-20 and 30-0-30 amp. They can be used in places where the voltage and current ranges are low and where they must stand considerable vibration. They are especially designed for use on automobiles.

Expanding Rotary Hack Saw

For cutting circular holes in metal, wood, slate, marble, etc., Barnes & Irving, Inc., Syracuse, N. Y., are marketing the Misener expanding rotary hack saw that is shown in the accompanying illustration. This tool consists of an outer rotary with circular grooves fastened on a shank. This shank has a centering drill at one



HACK-SAW BLADES FIT IN GROOVES

end and is arranged at the other end to fit the ordinary brace. The grooves of the rotary are designed so that when sharp blades are placed in the grooves different pipe sizes can be cut.

Trade Notes

REVOCATION OF CANADIAN BLANKET LICENSE POSTPONED.—The War Trade Board, Washington, D. C., gives notice of the revocation of the general import license, covering the importation of commodities from Canada and Newfoundland as to the shipment of articles on the list of restricted imports, which, by a ruling of the board published July 8, was to have been effective from July 20. It has now been postponed until Aug. 15.

CATALOGS AND PRICE LISTS FOR CHILE.—John R. Bradley, United States Consul at Punta Arenas, Chile, S. A., suggests, in a report to the Department of Commerce, that catalogs and price lists, or at least approximate information as to prices, be furnished local firms and the consulate for the installation of electric light plants. It is desirable that the catalogs be in Spanish, although those in English will be of use to a number of firms that have English employees.

GERMAN TRADE AND THE WAR.—The Department of Commerce, Washington, D. C., in its "Miscellaneous Series, No. 65," has published in book form "German Trade and the War," by Chauncey Depew Snow, assistant chief of the Bureau of Foreign and Domestic Commerce, and J. J. Kral of the research division. It deals with commercial and industrial conditions in war time and the future outlook. Special attention is given to the subject of raw materials and the import trade. The price is 25 cents, and the pamphlet is sold by the Superintendent of Documents, Government Printing Office, Washington, D. C.

INCREASE IN WAGES AT BOSCH MAGNETO PLANT.—A flat increase of 10 per cent in wages to all employees of the Bosch Magneto Company, Springfield, Mass., who are classed as wage earners was announced, effective Aug. 1. Nearly 900 employees will receive the increase, which was voluntarily established by the company after an extended investigation of earnings and expenses. Piece-work and day-rate employees will share in the raise. The plant is now being operated under the presidency of Joseph A. Bower, Arthur T. Murray being general manager and F. D. Norman factory manager. It is the third largest German-owned concern which has been taken over by the United States government under the direction of A. Mitchell Palmer, federal custodian of enemy property.

GOVERNMENT CONTRACTS.—The government departments at Washington, D. C., have made purchases and awarded contracts since July 17 as follows: General Engineering Depot of the Army—Cutter Electric Company, single-pole circuit breakers; Sperry Gyroscope Company, spares for high-intensity searchlights; United States Electrical Tool Company, spares for type K-M motors; Cooper Hewitt Electric Company, mercury-vapor lamps; H. W. Johns-Manville Company, asbestos felted insulation; Carroll Electric Company, cone shades, fuse plugs, porcelain cleats, cut-outs; General Electric Company searchlamp motors of 5 hp. and 3 hp., floodlighting projectors; Star Electric Motor Company, spares for lathes, drill presses, tube expanders; Garford Motor Truck Company, magneto batteries, breakers, low-tension wire; Winton Company, parts of power plants for searchlamps; Robbins & Myers Company, spares for motors for grinders.

CAMPBELL COMPANY NON-STRIKE AGREEMENT.—The Campbell Electric Company, Lynn, Mass., manufacturer of X-ray apparatus for the American expeditionary forces in France, has signed an agreement with its employees providing that no strike or walk-out shall take place during the period of the war. The agreement was signed by the company and by 150 employees, representing 75 per cent of the total payroll, and it provides that all grievances or demands shall be submitted to the War Labor Board, with the understanding that its decision shall be final. Recognition of the important war work of the company and its force was inserted in the text of the agreement. This agreement was executed during the first days of the walk-out at the General Electric Company's Lynn Works, and widespread expressions of appreciation of the loyalty of the employees to the country's welfare in the face of outside pressure are being heard in the Lynn and Boston districts.

THE PYROLECTRIC INSTRUMENT COMPANY of Trenton, N. J., has moved from 148 to 636 East State Street.

THE LOCKE INSULATOR MANUFACTURING COMPANY has moved its general sales office from Rochester to Victor, N. Y., where the factory is situated.

JOHN H. BARKER of New York City is the sales agent for the Breco Electric Company of Toledo, Ohio, manufacturer of electric charging apparatus for storage batteries.

THE CRESCENT TRUCK COMPANY of Elizabeth, N. J., has purchased from the Bethlehem Shipbuilding Corporation Moore plant all right, title and interest in the Crescent electric industrial truck.

RUTHERFORD & UPTEGRAFF, in the First National Bank Building of Pittsburgh, Pa., have been appointed exclusive representatives in the Pittsburgh and nearby territory for the Electrical Engineers' Equipment Company of Chicago.

J. AUSTIN MURPHY, one of the directors of the Crane Company and manager of the city sales department of Chicago, has sailed for France to look after the interests of the company, and particularly the interests of Crane men with the American expeditionary forces. Mr. Murphy's temporary address is in care of the American Express Company, No. 7 Rue Scribe, Paris.

CRANE LIMITED, CANADA, on June 1 was taken over by Crane Limited. E. C. Townsend, second vice-president of Crane Limited, is general manager for the Dominion, with headquarters at 128 Bleury Street, Montreal. H. M. Agnew at Winnipeg and J. E. McIlreevy at Vancouver, formerly managers of the Crane branch houses in those cities, continue as managers for Crane Limited.

THE NATIONAL PIPE BENDING COMPANY of New Haven, Conn., announces that it has just entered into an agreement with Franklin Williams, Inc., of 39 Cortlandt Street, New York City, to act as that concern's representative in New York City and vicinity. F. N. Currier is president of the company and E. T. Franzen secretary and treasurer. Their experience as manufacturers and sales agents of steel specialties makes the connection especially desirable.

THE INTERNATIONAL WESTERN ELECTRIC COMPANY, INC., recently incorporated, has offices at 195 Broadway, New York City. The new organization will take over the Western Electric Company's export and foreign business. The officers of the new company follow: H. B. Thayer, president; H. A. Halligan, vice-president; Gerard Swope, vice-president and general manager; R. H. Gregory, comptroller and secretary, and J. W. Johnston, treasurer. W. E. Leigh will be assistant foreign manager, with J. J. Gilbert as export sales manager.

THE ROBBINS & MYERS COMPANY of Springfield, Ohio, has begun work on the new one-story frame warehouse on the property of the company just adjoining the bridge near the Big Four tracks. The building will be 158 ft. by 148 ft. and will be floored with concrete. The newstructure will accommodate the traffic department and also the storage which now requires three warehouses in various parts of Springfield. Disposition of the space left vacant in Plant No. 1, first floor, by the removal of the traffic department has not yet been definitely decided. Among the possibilities which will probably be considered is that of turning the space over to the engineering department for motor testing, thereby relieving congestion elsewhere in the plant.

WILLIAM BLAKE PIERCE has been appointed Eastern district sales manager for the Edison Electric Appliance Company, with offices at 147 Waverley Place, New York City. This district covers New England, New York, Pennsylvania, Maryland, Delaware and the District of Columbia. Mr. Pierce was at one time sales manager of the Kansas City Electric & Telephone Supply Company. He was next employed by the Western Electric Company, being for seven years specialist in charge of appliance sales. Three years ago last November he became Eastern representative, covering New England, New York and Pennsylvania for the Hughes Electric Heating Company. Last September he went to Washington, D. C., and in January opened the government office of the Edison Electric Appliance Company. On June 15 he removed to New York City to take up his present work. Mr. Pierce will continue to supervise the government work, although P. L. Miles, formerly Southern district Hughes representative, is now the local government work representative at Washington.

Trade Publications

HOUSE PUMPS.—Electrically operated pumps, with automatic switches to cut in and cut out at predetermined pressures, are described in bulletin No. 45, issued by the Peters Pump Company, Kewanee, Ill.

ELECTRIC IRONS.—A folder entitled "C.-H. Electric Laundry Irons" may be obtained from the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Flatirons weighing 7½ lb. and 9 lb. are described and illustrated.

HYDRAULIC VALVE.—Large electrically operated and hand-operated valves suitable for hydroelectric plants are shown in bulletin No. 1, issued by the Larner-Johnson Valve & Engineering Company, Philadelphia. Standard sizes are also given.

BOILER ARCHES.—The Green Engineering Company, East Chicago, Ind., has issued a sixteen-page booklet describing and illustrating "Sealflex" arches, which are designed to increase boiler rating. The booklet tells the story of the development of these arches and illustrates features of their construction.

ELECTRIC GRAB-BUCKET HOIST.—Bulletin No. 48,938, being distributed by the Sprague Electric Works of the General Electric Company 527 West Thirty-fourth Street, New York City, describes and illustrates the application of its hoists, giving in addition engineering data concerning the various sizes.

WASHING MACHINES. — The Globe Manufacturing Company, Perry, Iowa, has issued a sixteen-page catalog illustrating and describing its "Quicker Yet" power-driven and hand-driven washers. The illustrations are shown in three colors. Descriptions and specifications of each machine are given.

LIGHTING FIXTURES.—C. G. Everson & Company, 70 West Lake Street, Chicago, has issued an eighteen-page catalog of its commercial lighting and ornamental lighting fixtures. The fixtures illustrated include those of the inclosing-bowl type, enameled-steel bowls and reflectors and ornamental pieces for decorative lighting.

MOTOR-OPERATED BRAKES.—"Motor-Operated Brakes for Alternating-Current Service" is the title of the new four-page booklet "A," being distributed by the Cutler-Hammer Manufacturing Company of Milwaukee. Dimensions, engineering data and the formula for determining the retarding torque required for any brake installation are given.

New Incorporations

THE ELECTRIC MOTOR CORPORATION of New York, N. Y., has been incorporated with a capital stock of $20,000 by G. Katz, S. Feldman and S. Wetzler, 583 Riverside Drive, New York, N. Y.

JOHN FORSYTH, LTD., of Kitchener, Ont., Canada, has been incorporated with a capital stock of $300,000 to manufacture engines, generators, machinery, etc. The incorporators are John D. Forsyth, Edwin W. Clement, William P. Clement and others.

A. A. GIDDINGS & COMPANY of Montreal, Canada, have been incorporated by Louis A. David, Louis P. Crepeau, S. H. R. Bush and others. The company is capitalized at $50,000 and proposes to manufacture electrical and mechanical appliances, machinery, etc.

THE SNOW-WHITCOMB COMPANY of New York, N. Y., has been incorporated with a capital stock of $50,000 by J. H. Westcott, Jr., R. E. Whitcomb and W. L. Snow, 3661 Broadway, New York, N. Y. The company proposes to manufacture and deal in electric lamps and fixtures.

THE MULTIX MOTORS COMPANIES, INC., of Chicago, Ill., has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $1,000,000 to manufacture motors, engines, etc. The incorporators are Samuel C. Wood and A. D. Suess of Chicago, Ill.

THE SALISBURY ELECTRIC COMPANY of Toronto, Canada, has been incorporated by George E. McCann, 15 Washington Avenue, Francis A. Hammond, Arthur F. Ball and others. The company is capitalized at $100,000 and proposes to manufacture electrical equipment, machinery, engines, motors, etc.

New England States

BOSTON, MASS.—Bids will be received at the office of the lighthouse inspector, Boston, Mass., until Aug. 20 for generating sets and switchboard. Further information may be obtained upon application to the above office.

MARLBORO, MASS.—Plans are being prepared for the erection of a new power plant, 30 ft. by 40 ft., at the works of the Koehler Manufacturing Company on Howland Street, to cost about $20,000.

WILTON, MASS.—The Milford Light & Power Company has secured the contract for equipping the Souhegan Woolen Mills for electrical operation. The mills will also be heated by electricity next winter.

HARTFORD, CONN.—Plans are being considered by the Connecticut Electrical Steel Company to rebuild the foundry and model department at its works, recently damaged by fire.

Middle Atlantic States

BUFFALO, N. Y.—Plans have been filed by the Barber Asphalt Paving Company, 178 Walder Avenue, for the erection of a new boiler plant, about 30 ft. by 125 ft. and 50 ft. by 195 ft., at its works, to cost approximately $50,000. Contract has been awarded to the Charles Berricks Sons Company, 1151 Main Street.

JAMAICA, N. Y.—Plans are under consideration by the Jamaica Water Supply Company, 14 Union Avenue, for the construction of a new electrically operated pumping station on Gilman Avenue.

MECHANICSVILLE, N. Y.—The capital stock of the Half Moon Light, Heat & Power Company has been increased from $150,000 to $200,000, the proceeds to be used for extensions and improvements.

NEW BRIGHTON, N. Y.—Application has been made to the Public Service Commission by the Staten Island Rapid Transit Company for authority to issue $1,500,000 in bonds, the proceeds to be used, in part, for improvements, etc.

NEW YORK, N. Y.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Aug. 12, under specification 3192, for furnishing and installing a plenum heating system, including motor-operated fans, heating stacks, ducts, piping, etc., at the structural shop, navy yard, New York.

NEW YORK, N. Y.—Bids will be received by the Interborough Rapid Transit Company at the office of the chief engineer, 165 Broadway, until Aug. 9 for completion of the passenger station, electric lighting and electric heating systems for portions of a rapid transit railroad in the boroughs of Brooklyn and Manhattan, as follows: Portion of Clark Street, Eastern Parkway and Nostrand Avenue lines. Further information, specifications, etc., may be obtained at the above office. George H. Pegram is chief engineer.

PEEKSKILL, N. Y.—Plans have been completed by the Weehawken (N. J.) Dry Dock Company for the construction of a shipbuilding plant at Peekskill, including machine shops, erecting shops, etc.

SYRACUSE, N. Y.—The capital stock of the Oswego River Power Transmission Company of Syracuse has been increased from $20,000 to $50,000.

MAY'S LANDING, N. J.—Contract has been awarded by the Bethlehem Loading Company for the construction of a new boiler plant, to cost about $16,000, to Albert Doak, 2138 Arch Street, Philadelphia, Pa. The company is erecting a large shell-loading plant here.

NEWARK, N. J.—The Public Service Railway Company is considering an extension of its system on the west side of the Hackensack River.

NEWARK, N. J.—Plans have been filed and contract awarded by the Northern Feather Works & Produce Company for the construction of a new power house at its plant on Backus Street.

NEWARK, N. J.—Bids will be received until Aug. 7 by the Board of Freeholders of Essex County, Newark, for construction of ten reinforced-concrete coal pockets and coal-conveying equipment for the Essex County Hospital at Overbrook. The cost is estimated at about $60,000.

PERTH AMBOY, N. J.—The Board of Aldermen is considering the construction of a high-pressure pumping plant on Carlock Avenue, near Pulaski Street in connection with the construction of a new reservoir for the water-works system. The station will be equipped with two units with a rating of 1,000,000 gal. daily each.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

POMPTON LAKES, N. J.—Bids will be received by the Borough Council, Municipal Building, until Aug. 7 for construction of power plant as follows: (1) For the erection of the foundation and all other work of hydraulic power station, except the superstructure; (2) erection of superstructure of building; (4) two vertical hydraulic turbines; (5) two electric generators and switchboards. Plans and specifications are filed with the borough clerk, from whom copies may be obtained upon deposit of $50. S. Firestone is consulting engineer.

WRIGHTSTOWN, N. J.—The Board of Public Utility Commissioners has granted the Wrightstown Utilities Corporation, recently incorporated, permission to take over the plant and property of the Wrightstown Water, Light & Power Company.

BETHLEHEM, PA.—A tract of land of about 300 acres has been obtained by the Bureau of Industrial Housing and Transportation on the outskirts of the city, just across the river from the plant of the Bethlehem Steel Corporation, on which it proposes to erect from 1200 to 1500 houses Contract has been awarded for construction of sewers, water supply, electric lighting, streets, etc. In addition to houses, certain community facilities, such as stores, moving-picture theater and recreation building, are necessary.

CONNERSVILLE, PA.—The Rex Company and the Central Manufacturing Company, it is reported, are each installing isolated electric power plants.

HARRISBURG, PA.—Permission has been granted by the Public Service Commission to several electric light and power companies to issue securities as follows: The Chester Valley Electric Company of Coatesville, $80,000; the Barnesborough-Spangler Electric Light Company of Philadelphia, $83,000, and the Hamburg (Pa.) Gas & Electric Company, $50,000.

HAZLETON, PA.—The Worthington Pump & Machinery Company is reported to be asking bids for the construction of an extension to its plant, 100 ft. by 200 ft., to cost about $25,000, and an electric power plant, to cost about $50,000.

MOUNT CARMEL, PA.—The Shamokin & Mount Carmel Transit Company has decided to close down its local power plant (to aid in the conservation of coal) and will purchase energy to operate its system from the Edison Electric Illuminating Company.

McKEE'S ROCKS, PA.—Work has begun by the Pressed Steel Car Company, Frick Building, Pittsburgh, on the construction of a new transformer building, 20 ft. by 20 ft., at its local plant.

PHILADELPHIA, PA.—Contract has been awarded by the United States government to Thomas Reilly, 1616 Thompson Street, for extensions to the transformer station at the aircraft plant at the local navy yard.

PHILADELPHIA, PA.—Plans have been prepared by the Department of Public Safety for the construction of a new municipal repair plant at Eleventh and Reed Streets, to cost about $40,000. New equipment, including motor-generators, boilers, air compressors and accessories, will be installed.

PITTSBURGH, PA.—Permission has been granted the Pennsylvania lines west of Pittsburgh by the Railroad Administration to erect a new locomotive repair shop and engine house at Stark, Ohio, to cost about $900,000, and for remodeling and improvements to shops and engine house at Wellsville, Ohio, at a cost of about $276,000.

TRENTON JUNCTION, PA.—Plans have been filed and contract awarded by the Philadelphia & Reading Railroad Company for the erection of a battery building, 20 ft. by 35 ft., at its local yards.

WASHINGTON, PA.—The Electric Reduction Company has awarded contract to the Austin Company of Cleveland, Ohio, for the construction of a two-story machine shop and boiler plant at its works, to cost about $15,000.

EDGEWOOD, MD.—Plans have been completed by the Ordnance Department, Washington, D. C., for new works at the Edgewood Arsenal at Edgewood, to be used for assembling, testing, etc., consisting of ten buildings, averaging 100 ft. by 200 ft. The cost is estimated at about $5,000,000. Contract for part of the work has been awarded to the Austin Company, Bulletin Building, Philadelphia, Pa.

INDIAN HEAD, MD.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Aug. 5, under specification 3193, for boilers and superheaters for the nitrate plant at Indian Head, Md. The cost is estimated at about $200,000. Bids will also be received until Aug. 25, under specification 3197, for mechanical stokers for nitrate plant at Indian Head. Further information may be obtained at the above bureau.

WHEELING, W. VA.—Improvements to the street lighting system are planned by the Street Lighting Commission and the Wheeling Commercial Association.

HUNTINGTON, W. VA.—Contract has been awarded by the Baltimore & Ohio Railroad Company for extensions and improvements to its local yards and car shops, to the Arnold Company, 105 La Salle Street, Chicago, Ill. The cost of the entire work is estimated at about $500,000.

ACCOTINK, VA.—The War Department has authorized an expenditure of $2,934,400 for enlarging Camp Humphreys, located at Accotink, to accommodate 30,000 troops. The work is being done by the construction division of the army. The plans calls for 200 barracks, 55 mess halls, 16 officers' quarters buildings. 4 medical buildings, 4 administration buildings, 4 post exchanges, 30 storehouses, 30 stables and sheds and 2 repair shops.

RICHMOND, VA.—Bids will be received by E. W. Trafford, superintendent of the municipal electric light plant, until Aug. 16 for surplus energy of the municipal electric plant. It is estimated that a maximum of 1000 kw. can be furnished between the hours of sunrise and sunset, and half of that amount during the rest of the 24 hours.

ST. JULIAN, VA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Aug. 12, under specification 3270, for construction of power house at St. Julian.

WASHINGTON D. C.—Bids will be received at the office of the purchasing clerk, Board of Awards, Department of Agriculture, Washington, D. C., until Aug. 9 for furnishing refrigerating machine at Rosslyn, Va.

WASHINGTON, D. C.—The United States Coast and Geodetic Survey has awarded contract to the Wils-Egelhof Company, 101 Park Avenue, New York, N. Y., for the erection of a building at South Capitol and New Jersey Avenues, to cost about $95,000.

WASHINGTON, D. C.—Bids will be received by the Department of Agriculture, Washington, D. C., until Aug. 9 for furnishing and installing a refrigerating machine at Arlington Farm, near Rosslyn, Va. Specifications, etc., may be obtained upon application to the chairman of board of awards, Department of Agriculture.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing apparatus and supplies at the various navy yards and naval stations as follows: Annapolis, Md., until Aug. 9, under Schedule 5097½—for furnishing 9600 ft. of steel conduit pipe. Eastern and Western navy yards, until Aug. 5, under Schedule 5108½—250 audible electric signal horns and howlers; Schedule 5134½—miscellaneous wire and cable; Schedule 5100½—1250 electric air heaters and 1250 electric foot warmers. Portsmouth, N. H., until Aug. 5, Schedule 5128½—one motor-generator set and one switchboard. Navy Yard, Connecticut, until Aug. 9, Schedule 5097½—for machine tools, including lathes, presses and motors, Brooklyn, N. Y., until Aug. 5, Schedule 5129½—for four generating sets; until Aug. 9, Schedule 5207½—300 ventilating sets. South Brooklyn, N. Y., until Aug. 5, Schedule 5132½—miscellaneous telephone equipment; Schedule 5200½—two air heaters and electrical wire and material. Philadelphia, Pa., until Aug. 5, Schedule 5131½—16 gasoline electric generating sets; Schedule 5158½—rubber-insulated electric wire and cable; Schedule 5167½—copper tubing; until Aug. 9, Schedule 5205½—350 battery charging panels. Washington, D. C., until Aug. 5, Schedule 5182½—eight electric hoists and spares. Various deliveries, until Aug. 5, Schedule 5165½, 255,000 ft. steel conduit; Schedule 5193½—floodlight projectors. Great Lakes, Ill., until Aug. 5, Schedule 5162½—8000 ft. steel conductor. 21,000 ft. rubber-covered wire and 425 lb. antenna wire. Further information may be obtained on application to the above bureau.

North Central States

BATTLE CREEK, MICH.—The plant of the Consumers' Power Company on Elm Street was recently damaged by fire, causing a loss of about $8,000.

ASHTABULA, OHIO. — Investigations are being made by F. R. Garver of Pittsburgh, Pa., engineer of a water-power development at Ashtabula. It is proposed to place three large dams in the Plymouth and Sheffield Gulfs, with the Ashtabula River as a feeder. The plans provide for the erection of a power plant at each dam.

BRYAN, OHIO.—The City Council has passed an ordinance authorizing an issue of $90,000 in bonds, the proceeds to be used for extensions and improvements to the municipal electric light plant and water-works system.

CANTON, OHIO.—The Timken Roller Bearing Company of Canton has awarded contract to the Canton Bridge Company for the erection of a new building, 90 ft. by 200 ft., to be used for storage purposes. It will be equipped with an electrically operated crane.

CINCINNATI, OHIO.—The War Department has selected the so-called Broadwell site for the half unit of the Air Nitrates Corporation plant to be located at Cincinnati.

CINCINNATI, OHIO.—William T. Johnson Company, Third and Vine Streets, it is reported, would like to receive prices on a 2000-kw., 220-volt direct-current generator directly connected to a Corliss engine.

CINCINNATI, OHIO.—Extensive improvements are contemplated in the equipment, properties and service of the Cincinnati, Dayton & Toledo Traction Company, which was recently taken over by the Cincinnati & Dayton Traction Company.

CLEVELAND, OHIO.—The Electric Products Company is contemplating the construction of a new factory, 90 ft. by 176 ft., at 1723 Clarkston Road.

HAMILTON, OHIO.—The proposed new tractor plant of Henry Ford & Son, to be erected in Hamilton, will be operated by hydroelectric power. The company, it is reported, has purchased the property of the Hamilton & Rossville Hydraulic Company and a five-acre site on the Baltimore & Ohio Railroad on which it will erect a 3000-kw. plant.

TOLEDO, OHIO.—Plans are being considered for the erection of a special pole line to carry the power cables from the new power plant of the Acme Power Company, controlled by the Cities Service Company, to the new government nitrate plant to be erected near Toledo. The proposed line will be erected under the supervision of the city authorities. The poles will be 7 ft. higher than those regularly in use. Telephone lines will strung on the poles at the regular height, while the power lines will be placed at the top.

LOUISVILLE, KY.—The Louisville Ice & Cold Storage Company, recently organized, has purchased from the Louisville Gas & Electric Company the two buildings on Bullitt Street formerly occupied by the Fetter Lighting Company, which will be operated as an ice plant. The ice company also took over the contract of the gas and electric company to supply ice to the Merchants' Ice & Cold Storage Company. The Louisville Gas & Electric Company has been making ice as a by-product since the plant was taken over from the Fetter company.

WILLARD, KY.—The Black Raven Coal Company is reported to be in the market for a 100-kw. or a 125-kw., 220-volt direct-current generator.

ARGOS, IND.—Plans are being prepared for rebuilding the Argos pumping station, which is to be equipped with electrically operated machinery. H. J. Fauber of South Bend is designing engineer.

GARY, IND.—Plans have been filed by the Union Drawn Steel Company for the construction of a boiler house, to cost about $8,000, which will enable the company to furnish power to operate its works.

HAGERSTOWN, IND.—The City Council is considering the purchase of a 150-hp. oil engine and a 75-kw., 220-volt direct-current generator, directly connected, for the municipal electric light plant. R. G. King is superintendent.

JEFFERSONVILLE, IND.—Among the improvements contemplated by the Pennsylvania Railroad Company to its local yards are included the installation of a 100-ft. turntable, to be operated by electricity; first section of machine shops, each unit to be 40 ft. by 160 ft.; a roundhouse, capable of housing 12 locomotives; a repair shop, new passenger station, etc.

CHICAGO, ILL.—Plans have been completed by the Atchison, Topeka & Santa Fé Railroad Company for the erection of a new power plant, 100 ft. by 100 ft., at Shopton, Ill.

CHICAGO, ILL.—Contract has been awarded by the Acme Steel Goods Company, Archer Avenue, Chicago, Ill., to the Morgan Construction Company of Worcester, Mass., for the construction of a building, 80 ft. by 100 ft., one story, on 130th Street, to cost about $100,000.

GREAT LAKES, ILL.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Aug. 5, under specification 3210, for construction of mess hall and power house at the naval station at Great Lakes, to cost approximately $200,000.

MADISON, ILL.—The planing mill of the Kettle River Creosoting Works was recently destroyed by fire, causing a loss of about $50,000. Considerable machinery, including generators, will have to be replaced.

MONMOUTH, ILL.—Plans are under consideration by the Monmouth Plow Company for the erection of a five-story building, 60 ft. by 90 ft., with power plant, to cost about $40,000.

MANITOWOC, WIS.—Bids will be received by the Board of Public Works until Aug. 5 for a 1500-kw. turbo-generator unit, one 300-hp. vertical water-tube boiler and underfeed mechanical stoking equipment.

PALMER, NEB.—Bonds to the amount of $40,000 have been voted for rebuilding the municipal electric light plant and water-works system.

Southern States

LINCOLNTON, N. C.—The Boger & Crawford Spinning Company, recently organized, has purchased a site in Lincolnton on which it proposes to erect a mill, 184 ft. by 104 ft., to have a capacity of 10,000 spindles (3300 ordered); the remainder will be installed when obtainable. The plant will be operated by electricity.

RALEIGH, N. C.—Improvements will be made to the electric power and heating equipment of the Central Hospital for the Insane, to cost about $90,000. Contract for extension to power house has been awarded to T. M. Copeland of Raleigh, at $23,000; for boilers and heating apparatus, including installation, to the General Fire Company of Charlotte, at $46,000. Albert Sanderson is superintendent.

WILSON, N. C.—Plans are being considered to increase the water supply. It is proposed to raise the dam and develop same. Sufficient power may be secured to operate the municipal electric light plant at night and Sundays.

COLUMBIA, S. C.—The Carolina Public Service Company is planning to erect an addition to its ice plant, increasing the capacity to 250 tons.

SPARTANBURG, S. C.—According to a decision handed down by the court the South Carolina Light, Power & Railways Company is to extend its electric railway to Whitney and Converse.

ATLANTA, GA.—At an election held recently the proposal to issue $800,000 in bonds for improvements to the water-works system and in the installation of a municipal electric lighting plant was defeated.

DADE CITY, FLA.—The Dade City Ice, Light & Power Company is reported to be contemplating extensions to its electric plant and ice factory, including the installation of additional machinery.

JACKSONVILLE, FLA.—The nitrate plant of the American Agricultural Chemical Company, located near Jacksonville, was recently destroyed by an explosion, causing a loss of about $1,000,000.

FLORENCE, ALA.—Work will begin at once by the Muscle Shoals Traction Company on its proposed railway to connect Huntsville and Florence.

DE QUEEN, ARK.—The local electric plant of the Arkansas Light & Power Company has been purchased by the Commonwealth Public Service Company of Muskogee, Okla.

OKMULGEE, OKLA.—The Boston-Arkansas Mining Company is contemplating the purchase of friction clutch and transmission equipment, belt-driven air compressors, electric generators, pumping machinery, etc.

STILLWATER, OKLA.—Bids will be received by the city of Stillwater until Aug. 12 on one 250-kva., three-phase, 2300-volt generator with exciter and switchboard; one 16-kva., 6.6-amp. constant-current transformer, one 300-hp. boiler and one 400-hp. open heater. J. L. Moore is commissioner of revenue and accounting.

NEW ORLEANS, LA.—The Quartermaster Corps, Washington, D. C., has awarded contract to the George A. Fuller Construction Company, Fuller Building, New York, N. Y., for construction of a system of warehouses on the Mississippi River and industrial canal, to cost about $10,000,000. The plans provide for three concrete warehouses, 140 ft. by 169 ft., six stories, and a two-story wharf, 2000 ft. long.

DALLAS, TEX.—The Dallas Power & Light Company is contemplating an addition to its plant, to cost about $15,000.

LUBBOCK, TEX.—Contract will soon be awarded by the City Council for the construction of a municipal electric light and power plant, to cost about $35,000.

Pacific and Mountain States

SEATTLE, WASH.—The City Utilities Committee has voted to recommend to the Council that sealing operations be resumed at the Cedar River Dam. The work was recently stopped owing to the shortage of water.

SEATTLE, WASH.—The officials of the city of Seattle have petitioned the Capital Issues Committee for authority to issue $5,500,000 in bonds for extensions to the municipal hydroelectric power plants to enable the municipal electric system to provide electricity for shipbuilding plants, industrial, transportation, etc., requirements during the war.

SEATTLE, WASH.—J. D. Ross, superintendent of lighting, has announced that plans are under way for the construction of an additional steam-driven electric generating unit of 10,000 kw. capacity, to meet the increasing demands for electrical service. The plant will either be built as an addition to the present Lake Union steam plant or will be erected at a coal mine. As soon as Mr. Ross has completed investigations the Council will be asked to authorize $500,000 in bonds.

BAY CITY, ORE.—The Cummings-Moberly Lumber Company of Louisiana has begun work on the construction of its proposed sawmill in Bay City. The plant will have an eight-hour capacity of 150,000 ft. A machine shop, 40 ft. by 75 ft., is included in the plans. The mill will be operated by electrically driven machinery throughout.

FALL RIVER MILLS, CAL.—A movement has been started to secure electrical service in the Big Valley district. It is proposed to erect electric transmission lines from the plant in Fall River Mills to Bieber and Big Valley to supply electricity for lighting and irrigation purposes. Supervisor Harry E. Wood is interested in the project.

PORTERVILLE, CAL.—Plans are under consideration by the City Council for the construction of a municipal electric light plant. Estimates prepared by F. W. Pease, city engineer, place the cost at about $12,000.

SACRAMENTO, CAL.—Bids will be received at the office of the State Bureau of Tuberculosis, Forum Building, Sacramento, until Aug. 12 for construction of an administration building, service building, power house, porch buildings, two cottages, nurses' home, superintendent's cottage and septic system. The buildings will be erected about one-quarter of a mile from the Weimar Station in Placer County. Plans may be seen at the office of J. E. Stanton, Associated Forum Building, Sacramento.

SAN FRANCISCO, CAL.—The Board of Supervisors of San Francisco has under consideration an extension of the Municipal Railways over Army Street to Petrero Avenue to provide transit service to the Union Iron Works, Hunter's Point and other industrial plants in that section of the city.

DENVER, COL.—Bids will be received by the United States Reclamation Service, Department of the Interior, Denver, Col., until Aug. 12 for furnishing one direct pumping unit with extra repair parts for the Price-Stub pumping plant, Great Valley project, Colorado. Further information may be obtained from R. F. Walter, acting chief of construction, Denver, Col.

Canada

VANCOUVER, B. C.—Permit has been granted to the Defiance Packing Company for the construction of a packing plant, to be equipped with considerable refrigerating equipment. The cost of the plant is estimated at about $50,000. A. H. Sherman is general manager.

NIAGARA FALLS, ONT.—Work has been resumed on the Chippewa-Queenston power project by the Ontario Hydro-Electric Power Commission. The proposed station will be located at Queenston. About 300,000 hp., it is estimated, will be developed. G. B. Goodwin is construction engineer for the project.

SMITH'S FALLS, ONT.—The purchase of four electrically driven pumps, to cost about $20,000, by the town of Smith's Falls has been recommended by the Provincial Hydroelectric Commission.

Miscellaneous

PANAMA—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Aug. 14 for galvanized pipe, sizing wire, brass tubing, storage batteries, pipe covering, etc. Blanks and further information relating to this circular (1225) may be obtained at the above office.

Directory of Electrical Associations

Printed in the First Issue of Each Month

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, A. H. Krom, 29 South La Salle St., Chicago, Ill.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West Fortieth St., New York City. Annual meeting Atlantic City, N. J., Oct. 8 and 9.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC. Secretary, F. A. Molitor, 35 Nassau St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS. University of Pennsylvania, Philadelphia, Pa.

ARKANSAS PUBLIC UTILITIES ASSOCIATION. Secretary-treasurer, W. J. Tharp, Little Rock, Ark.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General secretary, C. E. Dustin, 30 East 42d St., New York City.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, George C. Holberton, San Francisco, Cal.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa. Annual convention, Sept. 14-18, Baltimore, Md.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Joseph A. Andreucetti, Chicago & North Western Railway, Chicago, Ill.

BRITISH COLUMBIA ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary-treasurer, Capt. W. J. Conway, 406 Yorkshire Building, Vancouver, B. C. Annual meeting, Sept. 13-15, Victoria, B. C.

CANADIAN ELECTRICAL ASSOCIATION, affiliated with N. E. L. A. Secretary-treasurer, W. Volkman, Toronto Electric Light Co., Toronto, Ont.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col.

COMMERCIAL SECTION, N. E. L. A. Secretary, Henry Harris, Pittsburgh, Pa.

EASTERN NEW YORK SECTION, N. E. L. A. Assistant secretary, J. L. Hemphill, General Electric Co., Schenectady, N. Y.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, Shiras Morris, Hart & Hegeman, Hartford, Conn.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill. Meeting, Cleveland, Ohio, November.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRICAL CREDIT ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert E. Elliott, 502 Flatiron Building, San Francisco, Cal.

ELECTRIC POWER CLUB, Secretary, C. H. Roth, 1410 West Adams St., Chicago, Ill.

ELECTRIC VEHICLE SECTION OF THE N. E. L. A. Secretary, A. Jackson Marshall, 29 West 39th St., New York City.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West 39th St., New York City.

FLORIDA ENGINEERING SOCIETY. Secretary, J. R. Benton, Gainesville, Fla.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary, R. H. Abbott, Petersburg, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, Clarence L. Law. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston. Annual meeting Oct. 10.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donohue, Lafayette, Ind. Annual meeting, Indianapolis, Ind., Aug. 7.

INDUSTRIAL ELECTRIC HEATING ASSOCIATION. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

INSTITUTE OF RADIO ENGINEERS. Secretary Alfred N. Goldsmith, College City of New York, New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex. Annual convention, Atlanta, Ga., Sept. 24-27.

OKLAHOMA GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION. Secretary, L. W. W. Morrow, Norman, Okla.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA SECTION, N. E. L. A. Secretary-treasurer, M. G. Linn, Des Moines, Iowa.

JOVIAN ORDER. Jupiter (president), Henry J. F. Strickland, Dallas, Tex.; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo.

KANSAS PUBLIC SERVICE ASSOCIATION. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan. Annual meeting, Kansas City, Kan., Oct. 17-19, 1918.

MAINE ELECTRIC ASSOCIATION. Secretary-treasurer. Walter S. Wyman, Augusta, Me.

MICHIGAN SECTION, N. E. L. A. Secretary, Herbert Silvester, Detroit Edison Co., Monroe, Mich.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary, H. C. Hoffman, St. Paul Gas Light Co., St. Paul, Minn.

MISSISSIPPI ELECTRIC ASSOCIATION. Affiliated with the N. E. L. A. Secretary-treasurer, L. D. Gordon, Jackson Light & Traction Co., Jackson, Miss.

MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secretary-treasurer, F. D. Beardslee, 721 Locust St., St. Louis, Mo.

NATIONAL ASSOCIATION OF ELETRCICAL CONTRACTORS AND DEALERS. Secretary, H. C. Brown, 110 West 40th St., New York City, N. Y. State associations in Alabama, Arkansas, Connecticut, Georgia, Kansas, Illinois, Indiana, Iowa, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Jersey, New York, Ohio, Oregon, Pennsylvania, Tennessee and Wisconsin.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Concord, Mass.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, 33 West 39th St., New York City.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, R. W. McGinnis, O'Neil Light & Creamery Co., O'Neil, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 15 State St., Boston, Mass.

NEW ENGLAND SECTION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass. Annual meeting, Hotel Kimball, Springfield, Mass., Sept. 27 and 28.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, Charles E. Twogood, Albuquerque, N. M.

NEW YORK ELECTRICAL CREDIT ASSOCIATION. Secretary, Franz Neilson, 120 Broadway, New York City.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York City.

NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION. Affiliated with N. E. L. A. Secretary, George L. Myers, Pacific Power & Light Co., Portland, Ore. Annual meeting, Sept. 11, 1918.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

PACIFIC COAST SECTION, N. E. L. A. Secretary, A. H. Halloran, 618 Mission St., San Francisco, Cal.

PENNSYLVANIA ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary, M. G. Sellers, 1518 Sansom St., Philadelphia, Pa.

PUBLIC SERVICE ASSOCIATION OF VIRGINIA. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, W. C. Davisson, West Virginia Water & Electric Co., Charleston, W. Va.

RADIO CLUB OF AMERICA. Secretary, T. J. Styles, 152 Beach St., Yonkers, N. Y.

ROCKY MOUNTAIN ASSOCIATION OF MUNICIPAL ELECTRICIANS. President, Lawrence Stone, Denver, Col.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, 29 West 39th St., New York City.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

SOUTH DAKOTA ELECTRICAL POWER ASSOCIATION. Secretary-treasurer, O. J. Gronsdahl, Hartford, S. D.

SOUTHEASTERN SECTION, N. E. L. A. Secretary-treasurer, T. W. Peters, Columbus, Ga.

SOUTHERN CALIFORNIA ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary-treasurer, J. E. Wilson, 425 Consolidated Realty Building, Los Angeles, Cal.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 403-4 Slaughter Building, Dallas, Tex.

SOUTHWESTERN SOCIETY OF ENGINEERS. Secretary, C. E. Barglebaugh, 703 First National Bank Building, El Paso, Tex.

TORONTO ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, E. F. W. Salisbury, 615 Yonge St., Toronto, Ont.

TRI-STATE WATER AND LIGHT ASSOCIATION. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, A. B. Marsden, Rutland, Vt.

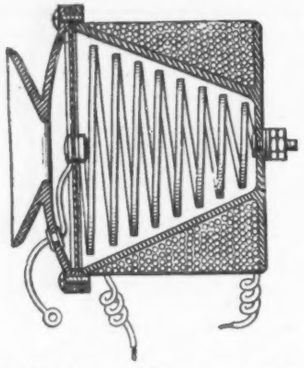
WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 West Jackson Blvd., Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago, Ill. Annual meeting, Chicago, Jan. 28-30, 1919.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, J. P. Pulliam, 1408 First National Bank Building, Milwaukee, Wis.

1,270,785. CIRCUIT-INTERRUPTING SYSTEM; Lewis W. Chubb, Edgewood Park, Pa. App. filed Nov 29, 1915. Means for automatically precluding the flow of current in a circuit, upon the occurrence of predetermined conditions, without opening the circuit.

1,270,789. CONTROLLER FOR ELECTRIC VEHICLES; De Witt C. Cookingham, Lakewood, and John H. Hertner, Cleveland, Ohio. App. filed March 20, 1913. To provide a warning device whereby the operator cannot carelessly leave the car standing with the current flowing through the motor.



1,270,920—Transmitter or Receiver

1,270,804. ELECTRICAL SYSTEM OF POWER TRANSMISSION AND REGENERATIVE BRAKING; Peter W. Rorsberg, Schenectady, N. Y. App. filed Oct. 29, 1917. Means for automatically regulating the current generated by dynamo-electric machines during the generator operation thereof.

1,270,805. RECTIFIER-EQUALIZING SYSTEM; Charles Le G. Fortescue, Pittsburgh, Pa. App. filed May 6, 1915. To provide means whereby a plurality of rectifying devices may each assume and maintain a definite portion of said load.

1,270,822. CIRCUIT INTERRUPTER; Rudolf E. Hellmund, Swissvale, Pa. App. filed July 6, 1917. An interrupter for an alternating-current circuit shall be tripped only when an overload current having a symmetrical wave shape traverses the circuit.

1,270,831. STATIC PROTECTIVE APPARATUS; Ray P. Jackson, Edgewood Park, Pa. App. filed July 29, 1913. The energy sustaining the flow of high-frequency currents in the disturbed circuit is absorbed and dissipated as heat.

1,270,843. ELECTRIC LAMP; Frederick G. Keyes, East Orange, N. J. App. filed June 26, 1914. For adequately supporting the filament and at the same time furnishing a convenient means for making connections inside the lamp.

1,270,885. SYSTEM OF DISTRIBUTION; Karl A. Simmon, Edgewood Park, and Paul L. Mardis, Wilkinsburg, Pa. App. filed Feb. 3, 1916. Voltage corrections effected by automatically varying the active length of a voltage-generating winding.

1,270,894. PROTECTIVE DEVICE; Charles P. Steinmetz, Schenectady, N. Y. App. filed Sept. 17, 1917. To select the phase of an electrical system upon which there is fault to ground before such fault develops into one of low resistance.

1,270,917. ELECTRIC REGULATOR; Hamilton Baluss, Kennett Square, Pa. App. filed Nov. 22, 1915. For maintaining lamp circuit under variations of voltage in the supply circuit.

1,270,920. TRANSMITTER OR RECEIVER; Konrad Botz, New York, N. Y. App. filed June 28, 1917. Has operatively connected with the diaphragm a helical cone of magnetic and current-conducting material.

1,270,957. ADJUSTABLE SUPPORT FOR COMMUTATOR BRUSHES; Petrus van Santen Kolfe, Philadelphia, Pa. App. filed Dec. 10, 1915. To provide a support for a brush whereby the brush may lie flat against the commutator.

1,270,967. ARMATURE FOR DYNAMO-ELECTRIC MACHINE; Fred N. Mizer, Elyria, Ohio. App. filed Nov. 8, 1916. Relates to armatures which are to be rotated at a high angular velocity, as automobile horns.

1,271,001. ELECTROMAGNETIC SWITCH; Paul H. Zimmer, Milwaukee, Wis. App. filed June 6, 1913. Adapted to hold open when the current in operating windings is high and to close when current decreases.

Record of Electrical Patents

Notes on United States Patents

1,271,030. IGNITION SYSTEM; Harry F. Geist, Racine, Wis. App. filed Feb. 23, 1916. Mechanism suitable for operating an igniter plug and the magneto which provides electric current for the plug.

1,271,032. AUTOMATIC TELEPHONE SYSTEM; Bernard C. Groh, Chicago, Ill. App. filed July 19, 1915. Methods of toll supervision in systems containing one or more automatic exchanges.

1,271,037. SPARK-PLUG INTENSIFIER; Henry W. Kakaska, Mandan, N. D. App. filed May 8, 1917. A device especially for use upon old or sooted spark plugs to renew the life and efficiency thereof.

1,271,050. LIGHTNING ARRESTER; Clarence H. Martin, Endeavor, Wis. App. filed May 23, 1917. The type in which a magnet by attracting an armature produces a ground connection.

1,271,051. SMELTING AND REFINING FURNACE; Otto J. Martin, Vancouver, B. C., Canada. App. filed July 28, 1917. Enables the full percentage of values to be recovered from the crude ore.

1,271,061. DYNAMO-ELECTRIC MACHINE; Robert V. Morse, Ithaca, N. Y. App. filed March 18, 1912. Machines having a continuous current flow not depending for its action on any periodic reversal of current in either the field or armature.

1,271,087. THERMAL CIRCUIT CLOSER; Ralph F. Schneider, New York, N. Y. App. filed May 15, 1914. Contact thermometer in which the mercury is instrumental in bringing about the electrical operation of an alarm.

1,271,093. ELECTRIC FURNACE CONTACT; Frederick T. Snyder, Oak Park, Ill. App. filed March 1, 1917. So constructed as to permit of being withdrawn from the furnace quickly.

1,271,106. TROLLEY CATCHER; George E. Waldo and Edward Fay Wilson, Chicago, Ill. App. filed Aug. 16, 1917. Adapted for operation by means of fluid under pressure.

1,271,124. SWITCHING DEVICE; William T. Booth, East Orange, N. J. App. filed Dec. 30 1916. A hook switch for use in subscribers' sets and which may be used indiscriminately in different types of sets.

1,271,127. TELEPHONE SYSTEM; William G. Britten, Fanwood, N. J. App. filed April 15, 1916. To maintain a nearly uniform working potential on the various energy-consuming circuits.

1,271,136. PROCESS AND APPARATUS FOR ELECTRODEPOSITION UNDER COMPRESSION; Edward G. Cook, Long Island City, N. Y. App. filed May 13, 1916. Whereby electrolytically deposited metallic articles of all forms may be solidly and homogeneously formed.

1,271,141. PRINTING-TELEGRAPH SYSTEM; Amos F. Dixon, Newark, N. J. App. filed April 15, 1915. A system particularly applicable where the various stations are separated by short distances.

1,271,148. STORAGE BATTERY; Bruce Ford, Philadelphia, Pa. App. filed May 21, 1917. A fitting between storage cells which affords a good foothold for workmen to walk on.

1,271,155. IGNITION DEVICE; Harry F. Geist, Sumter, S. C. App. filed Feb. 15, 1918. The current is supplied by a generator, the rotor of which is operated intermittently.

1,271,162. MECHANISM FOR CONTROLLING CARBON OR ARC LAMPS; Arthur W. Harris, Erdington, England. App. filed Feb. 25, 1916. Concerns automatic feeding of carbons.

1,271,164. IMPULSE TRANSMITTERS; Henry Hovland, East Orange, N. J. App. filed Feb. 8, 1917. Device simple in structure and operation by which impulses may be sent rapidly and accurately.

1,271,171. TELEPHONE SYSTEM; Lewis H. Johnson, Bloomfield, N. J. App. filed Jan. 22, 1915. For interconnecting common battery and magneto or local battery lines terminating at a central office.

1,271,183. ARC OSCILLATION GENERATOR; Benjamin Liebowitz, New York, N. Y. App. filed Jan. 28, 1915. A simple and inexpensive generator for producing electrical oscillations.

1,271,185. TELEPHONE-EXCHANGE SYSTEM; Alben E. Lundell, New York, N. Y. App. filed Dec. 22, 1915. Means at one office for supervising the establishment of a connection through a plurality of offices.

1,271,186. TELEPHONE-EXCHANGE SYSTEM; Alben E. Lundell, New York, N. Y. App. filed Nov. 13, 1916. An operator's telephone set may be automatically associated with a calling subscriber's line.

1,271,190. WIRELESS-TELEGRAPH TRANSMITTER; Guglielmo Marconi, London, England. App. filed April 30, 1914. Means by which it may be possible to put a very large amount of power into the aerial.

1,271,200. METHOD OF AND APPARATUS FOR SMELTING TIN; Edmund N. Morrill, Warren, N. H. App. filed Nov. 27, 1917. The apparatus comprises an electric incandescent furnace of special construction.

1,271,215. BOX KNOCK-OUT; Clarence D. Platt, Bridgeport, Conn. App. filed Aug. 11, 1917. May be readily removed to provide an opening for the insertion of an insulating bushing.

1,271,216. SWITCH BOX; Clarence D. Platt, Bridgeport, Conn. App. filed Dec. 21, 1917. To provide a practical and efficient boxing for protecting the meter connections.

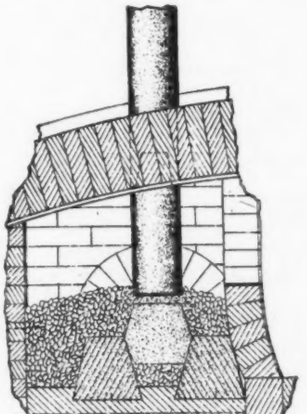
1,271,217. ELECTRICAL RECEPTACLE; Clarence D. Platt, Bridgeport, Conn. App. filed Feb. 15, 1917. To facilitate the connection of the circuit wires to the terminals without cutting.

1,271,220. ELECTRIC SWITCH; Martin J. Quinn, Toronto, Canada. App. filed June 12, 1916. Relates to a pressure-motor-operated switch automatically opening and closing an electric circuit.

1,271,221. ELECTRIC SWITCH; Martin J. Quinn, Toronto, Ontario, Canada. App. filed Jan. 15, 1917. A combination for making and breaking an electric circuit.

1,271,226. ELECTRICAL CONNECTOR; James E. Rork, Kalamazoo, Mich. App. filed June 18, 1917. For use with terminals that may be applied or secured to other terminals of a variety of different shapes.

1,271,229. PROCESS OF MAKING HIGH-PERCENTAGE CALCIUM CARBIDE; Duke R. Russell, Chicago, Ill. App. filed Feb. 4, 1918. Process of making a special pitch coke of 94 per cent or better in fixed carbon content and otherwise of a high percentage of purity.



1,271,280—Electric Furnace

1,271,245. SEAL FOR VAPOR-ELECTRIC APPARATUS; Max von Recklinghausen, Suresnes, France. App. filed July 12, 1913. For a leading-in conductor through the walls of vessels of quartz or similar material.

1,271,280. ELECTRIC FURNACE; Edgar F. Collins, Schenectady, N. Y. App. filed May 12, 1917. Suitable for industrial operations such as the melting of metals and the heating of steel for forging, annealing and tempering.